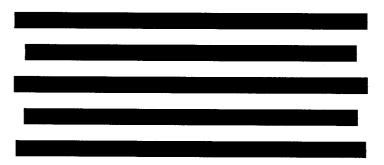
ENVIRONMENTAL ASSESSMENT

Aquatic Rodent Damage Management in North Carolina

Prepared By: UNITED STATES DEPARTMENT OF AGRICULTURE ANIMAL AND PLANT HEALTH INSPECTION SERVICE WILDLIFE SERVICES

In Cooperation With:



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SUMMARY OF PROPOSED ACTION

The United States Department of Agriculture, Animal and Plant Health Inspection Service, North Carolina Wildlife Services (NCWS) proposes to continue the current program of assisting landowners and managers by administering an aquatic rodent [beaver (Castor canadensis), nutria (Myocastor coypus), and muskrat (Ondatra zibethica)] damage management program in North Carolina. The types of damage that resource owners and managers seek to alleviate include threats to human health and safety and losses of property resulting from flooding of timber and other agricultural lands, residential and commercial property, and roads; cutting and flooding of commercial and ornamental trees and tree plantations; failure of road beds, railroad beds, and pond dams due to impounded water and burrowing; and structural degradation of storm water ditches. Damage management will be conducted on public and private property throughout the state of North Carolina only when resource owners or managers request assistance to alleviate aquatic rodent damage and/or upon agreement of resource owners or managers when necessary to assist adjacent resource owners or managers. An Integrated Wildlife Damage Management (IWDM) approach will be used to reduce damage associated with aquatic rodent activities. An IWDM strategy seeks to preserve and enhance the beneficial aspects of the wildlife species involved, encompasses the use of practical and effective nonlethal and lethal methods of preventing and reducing damage, and minimizes the harmful effects of damage management measures on humans, other wildlife species, and the environment. Under this action, NCWS will provide technical assistance and operational damage management, including nonlethal and lethal management methods by applying the Wildlife Services (WS) Decision Model (Slate et al. 1992). When appropriate, physical exclusion, water control structures, or habitat modification will be recommended and utilized to reduce aquatic rodent damage. In other situations, aquatic rodents will be lethally removed using conibear-type traps, snares, foothold traps, colony traps, and shooting. In determining the damage management strategy, preference will be given to practical and effective non-lethal methods. However, non-lethal methods will not always be applied as a first response to each damage problem. The most appropriate response may be a combination of non-lethal and lethal methods, or application of lethal methods only.

ACRONYMS

ADC Animal Damage Control

APHIS Animal and Plant Health Inspection Service
AVMA American Veterinary Medical Association
BMAP Beaver Management Assistance Program

CCC Cultural Carrying Capacity

CDFG California Department of Fish and Game CEQ Council on Environmental Quality

CFR Code of Federal Regulations

CWA Clean Water Act

EA Environmental Assessment
EIS Environmental Impact Statement

EJ Environmental Justice

EPA U.S. Environmental Protection Agency

ESA Endangered Species Act

FEIS Final Environmental Impact Statement

FDA Food and Drug Administration

FIFRA Federal Insecticide, Fungicide, and Rodenticide Act

FY Fiscal Year

IWDM Integrated Wildlife Damage Management

MIS Management Information System
MOU Memorandum of Understanding
NEPA National Environmental Policy Act

NCCES
North Carolina Cooperative Extension Service
NCDA
North Carolina Department of Agriculture
NCDOT
NORTH Carolina Department of Transportation
NCDFR
North Carolina Division of Forest Resources
NCWRC
North Carolina Wildlife Resource Commission

NCWS North Carolina Wildlife Services

NRCS Natural Resource & Conservation Service

NWP Nationwide Permit

SOP Standard Operating Procedure T&E Threatened and Endangered USACE U.S. Army Corps of Engineers

USC United States Code

USDA U.S. Department of Agriculture

USDA-WS U.S. Department of Agriculture-Wildlife Services

USDI U.S. Department of Interior
USFWS U.S. Fish and Wildlife Service
WAC Wildlife Acceptance Capacity
WDCA Wildlife Damage Control Agent

WS Wildlife Services

NOTE: On August 1, 1997, the Animal Damage Control program was officially renamed to Wildlife Services. The terms Animal Damage Control, ADC, Wildlife Services, and WS are used synonymously throughout this Environmental Assessment.

Chapter 1 NEED AND PURPOSE FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as human populations have expanded and land has been modified to meet human needs. Human population growth and land use changes often compete with wildlife and increase the potential for conflicting human/wildlife interactions. In addition, over protection of wildlife, particularly in urban areas, can create localized conflicts between human and wildlife activities. Some species of wildlife have adapted to and thrive in the presence of humans. These species are often responsible for the majority on human/wildlife conflicts. The *Animal Damage Control Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (USDA) 1997):

"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances... Wildlife is generally regarded as providing economic, recreational and aesthetic benefits... and the mere knowledge that wildlife exists is a positive benefit to many people. However... the activities of some wildlife may result in economic losses to agriculture and damage to property... Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well."

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1992). WS uses an Integrated Wildlife Damage Management (IWDM) approach, also known as Integrated Pest Management (IPM) (WS Directive 2.105¹), which seeks to preserve and enhance the beneficial aspects of the wildlife species involved, encompasses the use of practical and effective nonlethal and lethal methods of preventing and reducing damage, and minimizes the harmful effects of damage management measures on humans, other wildlife species, and the environment. IWDM is described in Chapter 1:1-7 of USDA (1997). The alleviation of wildlife damage involves one or more of three basic actions: 1) management of the resource being negatively affected, 2) management of the wildlife responsible for, or associated with, the damage, and 3) physical separation of the two.

Wildlife Acceptance Capacity (WAC), or Cultural Carrying Capacity (CCC), is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations (Decker and Purdy 1988). WAC is not a static number, but is defined by numerous dynamic factors such as human acceptance thresholds for damage and nuisance associated with the wildlife species in given situations, perceived interspecific competition, the role of the species in the transmission of disease to humans or other animals, and the values placed by people on this species. These values include economic, aesthetic, ecological, scientific, intrinsic, or educational values (Decker and Purdy 1988). Thus, different groups or individuals may have different WAC for the same species at any given time, dependent upon their values and tolerances.

WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

Because of the dynamic nature of WAC, WS has not defined these limits in this EA. WAC are determined on a site-specific basis by the individuals or organizations sustaining damage from aquatic rodents (beaver, muskrat, and nutria).

Biological Carrying Capacity (BCC) is the land or habitat's limit for supporting healthy populations of wildlife without degradation to the animals' health or their environment over an extended period of time (Strickland et al. 1994, Decker and Purdy 1988, Wolfe and Chapman 1987). In this context, a healthy population is one in which the animals do not suffer from a scarcity of necessary resources such as food, water, shelter, or space. Precise estimates of BCC are rarely if ever available (Strickland et al. 1994) and in agricultural and urbanized areas BCC generally greatly exceeds the WAC and is therefore only of academic interest (Strickland et al. 1994). Like the WAC, BCC is also dynamic in that it fluctuates in response to variations in environmental conditions such as weather or seasonal changes or changes in land use and development that affect the availability of food or other habitat requirements (Wolfe and Chapman 1987). Thus, BCC is difficult to define and is best left as a general concept rather than a definable entity (Wolfe and Chapman 1987).

These terms are especially important in urban areas because they define the sensitivity of a local community to a specific wildlife species. For any given damage situation, there will be varying thresholds for those directly and indirectly affected by the damage. While the State of North Carolina may have a biological carrying capacity to support more than the current number of aquatic rodents, the wildlife acceptance capacity may already have been exceeded in some parts of the state. Once the wildlife acceptance capacity is met or exceeded, people begin to demand implementation of population or damage reduction methods, including lethal management methods, to alleviate property damage and public health or safety threats.

This environmental assessment (EA) documents the analysis of the potential environmental effects of a proposed NCWS aquatic rodent damage management program designed to achieve a balance between biological carrying capacity and cultural carrying capacity. This analysis relies mainly on existing data contained in published documents (Appendix A), including the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997) to which this EA is tiered. This document may be obtained by contacting the USDA, Animal and Plant Health Inspection Service (APHIS), WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS is the federal agency directed and authorized by law to protect American resources from damage associated with wildlife [Animal Damage Control Act of March 2, 1931, as amended 46 Stat. 1486; 7 USC. 426-426c and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 USC 426C)]. To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources, property, and public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Wildlife damage management is not based on punishing offending animals but is a means of preventing and reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). The need for action is derived from actual damage or threats to resources or the public. The threat of damage or loss of resources is often sufficient for individual actions to be initiated.

Normally, according to APHIS procedures for implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, (1995)). In this case, WS has decided to prepare an EA to: 1) facilitate planning, interagency coordination, and the streamlining of program management, 2) to evaluate any potentially significant or cumulative impacts from the proposed damage management program, and 3) to clearly communicate this analysis with the public. Notice of the availability of this document will be published in newspapers, consistent with the agency's NEPA procedures.

WS is a cooperatively-funded, service-oriented program from which other agencies, groups or individuals may request assistance. All services are provided only at the request of agencies, groups or individuals experiencing wildlife damage problems. Before any wildlife damage management is conducted, written contracts are executed. All wildlife damage management conducted in North Carolina is undertaken according to relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). The WS mission, developed through its strategic planning process, is: "to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources and to safeguard public health and safety." WS's Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- Training of wildlife damage management professionals;
- Development and improvement of strategies to reduce losses and threats to humans and wildlife;
- Collection, evaluation, and dissemination of management information;
- Informing and educating the public on how to reduce wildlife damage;
- Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1999)

1.1 HISTORY

1.1.1 Beaver

Historically, beaver populations were likely limited by habitat conditions and exploitation by native Americans, since 1) climax forest types which historically covered the eastern United States have a relatively low carrying capacity for beaver in comparison with forests in younger growth stages, and 2) beaver were important to native Americans for food, clothing, tools, and items of trade. These factors coupled with the onset of the North American fur trade by Europeans in the early 1600's and the westward advancement of settlement led to the decline in beaver populations in North America (Novak 1987a). Beaver pelts were the most important item in the early fur trade (Wright 1987). In the 1700's beaver harvests remained high, but harvests declined continually during the 1800's and reached a record low during the years of 1900-1919 (Novak 1987a).

In North Carolina, beaver historically were considered a valuable natural resource and were an extremely important part of the economy. Well into the 1800's, beaver fur was the primary item of trade, and without trapping or hunting regulations, beaver were trapped to near extinction by the late 1890's (Owen et al. 1987).

Cutting and burning of climax forest types along with the development and implementation of wildlife conservation and management measures led to the recovery of beaver populations in much of North America (Novak 1987a). In 1939, in an effort to assist the public and effectively manage wildlife and natural resources in the state, the North Carolina Department of Conservation and Development (the predecessor of the North Carolina Wildlife Resources Commission) (NCWRC) obtained 29 beaver from Pennsylvania and released them in North Carolina on what is now the Sandhills Game Lands. Because of high economic and aesthetic values, public demand for beaver restocking remained high, and restocking programs were continued between 1951 and 1957 with an additional 54 beaver being stocked over a nine county area. The restocking and management efforts of NCWRC were successful and by 1959 there were an estimated 1000 beaver over a seven county area in the state. Today beaver occupy watersheds throughout most of the state (Woodward et al. 1985, Owen et al. 1987), and the population is still increasing (P. Sumner, NCWRC, pers. com).

While beaver populations are thriving and expanding throughout the state, resource use practices have changed and there is no longer as high a demand for beaver products as there was in the past. Following the decimation of the beaver population in the 1800's and early 1900's and the subsequent closing of the trapping season, the number of beaver trappers declined. By the time the trapping season was reopened, low demands for short-haired fur in

combination with a scarcity of beaver trappers resulted in minimal amounts of beaver trapping. Inadequate levels of beaver harvest in conjunction with insignificant non-human predation, and an abundance of suitable habitat resulted in beaver populations expanding to levels in some areas where the animals are in conflict with the health, safety, and livelihood of people (Woodward 1983, Woodward et al. 1985, P. Sumner, NCWRC, pers. com). The subsequent decline in fur prices in the early 1980's in combination with other factors led to further increases in beaver populations, with beaver damage being extensive in some areas. Beaver damage is currently still increasing due to the increasing beaver population and increasing human development in the vicinity of suitable beaver habitat (P. Sumner, NCWRC, pers. com).

A variety of attempts have been made to reduce damage caused by beaver in the southeastern U.S. A Beaver Cooperative Association formed in Mississippi in 1977 showed promise for reducing beaver damage by increasing the marketability of beaver pelts, but this program eventually failed due to low pelt values on international markets (Woodward 1983). A cooperative program between various agencies in North Carolina which attempted to reduce beaver damage by allowing trappers to harvest more valuable furs (Woodward 1983) also showed promise but failed due to the decline in the fur markets in the early 1980's. At least three North Carolina counties have attempted to use bounties to manage beaver damage, but these efforts have proven unsuccessful. In the meantime, continuing its efforts to assist the public and effectively manage natural resources, NCWS in cooperation with the and several other state and private agencies initiated the Beaver Management Assistance Program (BMAP). This cooperative program has been successful in reducing or eliminating beaver damage from specific problem sites while at the same time preserving and enhancing all the benefits which have been historically and continue to be derived from beaver. NCWS has a nine-year track record of providing excellent aquatic rodent damage management service to cooperators in North Carolina. A survey of over 300 cooperators in 1997 showed that the vast majority of cooperators were highly satisfied with the aquatic rodent damage management services provided by NCWS.

1.1.2 Muskrat

Muskrats were frequently utilized by native Americans but not to the extent that beaver were utilized (Wright 1987). Muskrats continue to be one of the most heavily utilized North American furbearers (Novak 1987a). During the 1982-83 trapping season, 7.4 million muskrats were harvested in the United States (Boutin and Birkenholz 1987). Muskrat damage is not a widespread problem but can be significant in localized situations (Wade and Ramsey 1986).

1.1.3 Nutria

Nutria, highly adaptable and hardy animals, are native to South America and became established in the United States in the 1930's and 40's after escapes and releases following the promotion and failure of nutria fur farming. In some areas nutria were released to control aquatic weeds, and several state and federal agencies relocated and stocked nutria. The average annual harvest of nutria in the United States between 1977 and 1984 was 1.3 million animals (Kinler et al. 1987). Nutria are considered abundant in North Carolina, and they occupy suitable habitat along the coast and several miles inland (P. Sumner, NCWRC, pers. comm.).

1.2 BENEFICIAL AND DETRIMENTAL IMPACTS OF AQUATIC RODENTS

1.2.1 Benefits of Beaver Activities

Since the first successful reintroduction of beaver into North Carolina in 1939, populations in the State have expanded dramatically (Arner and Dubose 1982, Woodward 1983, Sumner 1993). Along with this population expansion has come an increase in benefits derived from beaver, e.g., wetland habitat for many species of animals and plants; reduced soil erosion and downstream sedimentation; water for irrigation, livestock or wildlife during

drought; and recreational, educational, economic, and aesthetic opportunities (Grasse and Putnam 1955, Woodward 1983).

Beaver-created habitats are beneficial for many species of fish and wildlife. In particular, dam building and tree cutting cause the flooding and opening of forest habitats resulting in a greater diversity and interspersion of successional stages and habitat types (Arner and DuBose 1982, Arner and Hepp 1989, Hill 1982, Jenkins and Busher 1979, Medin and Clary 1990, 1991, Novak 1987a). The creation of standing water, edge, and plant diversity, all in close proximity, results in excellent wildlife habitat (Hill 1982) that is beneficial to fish, reptiles, amphibians, waterfowl, shorebirds, furbearers, and other animals (Arner and DuBose 1982, Miller and Yarrow 1994, Naimen et al. 1986). When ponds are abandoned, they progress through successional stages which improve feeding conditions for deer (*Odocoileus virginianus*), swamp rabbits (*Sylvilagus aquaticus*), and woodcock (*Philoela minor*) (Arner and DuBose 1982). In addition, beaver ponds may be beneficial to threatened and endangered species (T&E species). The USFWS estimates that up to 43% of T&E species rely directly or indirectly on wetlands for their survival (EPA 1995).

Waterfowl use beaver-created wetland habitats extensively (Arner and Hepp 1989, Speake 1955, Arner 1964, Novak 1987a, Hill 1982). In particular, wood ducks (Aix sponsa), mallards (Anas platyrhynchos), black ducks (Anas rubripes), and other dabblers benefit from the increased interspersion of cover and food found in flooded beaver ponds (Novak 1987a, Arner and Hepp 1989). The attraction of beaver ponds to waterfowl varies with age and vegetation (Arner and DuBose 1982). In Mississippi, beaver ponds over three years in age were found to have developed plant communities which increase their value as nesting and brood rearing habitat for wood ducks (Arner and DuBose 1982). Reese and Hair (1976) found that beaver pond habitats were highly attractive to a large number of birds year-round and that the value of the beaver pond habitat to waterfowl was minor when compared to other species of birds (Novak 1987a).

Beaver ponds improve soil quality and provide improved habitat for fish and invertebrates. The anaerobic conditions caused by beaver impoundments result in a threefold increase in organic nitrogen stored in the soil during a 50 year period (Johnston 1994). Arner et al. (1969) reported that the bottom soils of beaver ponds in Mississippi were generally higher in phosphate, potash, and organic matter than the bottom soils of feeder streams. Greater biomass of invertebrates and healthier fish were also found in beaver ponds than in feeder streams (Arner and DuBose 1982).

Beaver ponds help to maintain the quality of water systems (Arner and Hepp 1989) by contributing to the stabilization of water tables, helping to reduce rapid run-off from rain (Wade and Ramsey 1986), and serving as basins for the entrapment of nutrients, silt, and eroding soil. Silt-laden waters slow as they pass through a series of beaver ponds and the particulate matter is able to settle out. Aquatic and early successional plant species become established in the newly deposited sediment, which leads to favorable conditions for the stabilization of the flood plain by more permanent woody vegetation (Hill 1982). The Minnesota Department of Natural Resources has computed an average cost of \$300 to replace each acre-foot of flood water storage that wetlands can provide (EPA 1995). Producing wetlands/marsh habitat through beaver management in New York was far less costly than developing either small or large manmade marshes, assuming the quality is equal in each case (Ermer 1984).

Wetlands provide aesthetic and recreational opportunities for wildlife observation and photography, nature study, hunting, fishing, trapping, and environmental education and added an estimated \$59.5 million to the national economy in 1991 (EPA 1995, Woodward 1983, Wade and Ramsey 1986).

Beaver are generally considered beneficial where their activities do not compete with human land use or human health and safety (Wade and Ramsey 1986). The opinions and attitudes of individuals, organizations, and communities vary greatly and are primarily influenced and formed by the benefits and/or damage directly experienced by each individual (Hill 1982). Woodward et al. (1976) found that 24% of landowners who reported

beaver activity on their property indicated benefits to having beaver ponds on their land and also desired assistance with beaver pond management (Hill 1976, Lewis 1979, Woodward et al. 1985).

1.2.2 Damage from Beaver Activities

Along with the increase in benefits derived from beaver, there has also been an increase in detrimental impacts. In some cases, the detrimental impacts of beaver outweigh the benefits (Grasse and Putnam 1955, Woodward et al. 1985, Novak 1987a). In the southeastern United States, thriving beaver populations have negatively impacted the economy, with the overwhelming magnitude of damage far surpassing pelt values. It is estimated that beaver cause \$75 - 100 million dollars in economic losses annually in the United States, with total losses in the southeastern United States over the past 40 years estimated to be \$4 billion (Novak 1987a). In some southeastern states, losses from beaver damage have been estimated at \$3 - 5 million annually (Miller and Yarrow 1994).

The most obvious, widespread and common damage caused by beaver is the long-term flooding and subsequent death of timber (Hill 1976, 1982, Lewis 1979, Woodward et al. 1985). Tracts of bottomland hardwood timber up to several thousand acres in size may be lost to beaver activity (Miller and Yarrow 1994). Timber damage caused by beaver activity in southeastern states has been estimated at \$2.2 million annually in Mississippi (Arner and Dubose 1982), \$2.2 million in Alabama (Hill 1976), \$45 million in Georgia (Godbee and Price 1975), and \$14.5 million in Louisiana in 1993 (Fowler et al. 1994). A single landowner in North Carolina lost \$45,000 in timber to beaver activity (Loeb 1994). This document is concerned with the entire state of North Carolina, including the piedmont, sandhills, and coastal regions where timber damage tends to be particularly severe due to large acreages of easily-flooded relatively-flat terrain (Hill 1976).

Other types of property damage caused by beaver include girdling and cutting of ornamental and shade trees; flooding of pastures, cropland, homes, yards, septic tanks, or other urban areas; damming of culverts and bridges causing flooding and erosion of roadways and railroad beds; undermining or weakening of pond dams, roadbeds and yards from burrowing; plugging overflow pipes or spillways of ponds; interference with irrigation systems; drowning of livestock; feeding on crops; and gnawing on boat houses and docks (De Almeida 1987, Grasse and Putnam 1955, Hill 1982, Miller 1983, Miller and Yarrow 1994, Woodward 1983, Wade and Ramsey 1986).

Many of these types of damage have been documented in North Carolina (Woodward et al. 1985, Loeb 1994). In a 1984 postal survey, North Carolina landowners reported a total loss of \$2.35 million to various types of beaver damage (Woodward et al 1985). North Carolina Department of Transportation (NCDOT) roadway maintenance personnel in Johnston County spent a third of their time combating beaver damage to roadways (Loeb 1994). A survey conducted by the North Carolina Cooperative Extension Service in 1991 set annual losses in Columbus County, North Carolina at \$1.1 million (G. McCullen, NCCES, pers. comm.) Surveys of landholders in Eastern North Carolina counties conducted in 1993, 1994, 1995, 1996, 1997, and 1998 by the U.S. Department of Agriculture in North Carolina indicate minimum annual economic losses of \$1.2, \$0.5, \$1.1, \$0.8, \$2.7, and \$3.8 million, respectively, in beaver damage. In 1994 and 1995 the North Carolina Department of Transportation (NCDOT) documented over \$1 million in expenditures to repair and maintain state roadways damaged by beaver related activities (J. Lee, NCDOT, unpublished data).

Beaver activity can also become a threat to human health and safety. For example, burrowing into or flooding of roadways and railroad beds can result in serious accidents (Miller 1983, Woodward 1983). Beaver activity resulted in the the derailment of a train in Pitt County North Carolina on February 1, 2000. Residents in the area had to be evacuated due to the resulting chemical spill and fire (The Daily Reflector, Friday, February 4, 2000; Rocky Mount Telegram, Tuesday, May 8, 2001). Increased water levels in urban areas resulting from beaver activity can lead to

unsanitary conditions and potential health problems by flooding septic systems and sewage treatment facilities (De Almeida 1987, Loeb 1994). Beaver activity also creates conditions favorable to mosquitoes and poisonous snakes and can result in population increases of these animals (Wade and Ramsey 1986). While the presence of these animals is largely a nuisance, mosquitoes can transmit potentially fatal diseases, such as encephalitis (Mallis 1982). In addition, beaver, which are carriers of the intestinal parasite Giardia lamblia, can contaminate human water supplies and cause outbreaks of the disease Giardiasis in humans (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986, Miller and Yarrow 1994, Davidson and Nettles 1997). The Centers for Disease Control have recorded at least 41 outbreaks of waterborne Giardiasis, affecting more than 15,000 people. Although most outbreaks of giardiasis are attributable to the contamination of water supplies by human waste (Erlandsen et al. 1990), beaver have been linked with the occurrence of G. lamblia at some sites (Davidson and Nettles 1997). Beaver are also known carriers of tularemia, a bacterial disease, that is transmittable to humans through bites by insect vectors or infected animals or by handling animals or carcasses which are infected (Wade and Ramsey 1986). Skinner et al. (1984) found that in cattle-ranching sections of Wyoming the fecal bacterial count was much higher in beaver ponds than in other ponds, something that can be a concern to ranchers and recreationists. On rare occasions, beaver may contract the rabies virus and attack humans. In June 1997, a beaver attacked boaters at Lake Jorden in North Carolina, and in August 1997, another beaver attacked a swimmer at the same lake. Both beaver were killed and tested positive for rabies (The Chatham News June 19, 1997, The News and Observer August 2, 1997, The Chatham Record August 7, 1997). In February 1999, a beaver attacked and wounded a dog and chased some children that were playing near a stream in Vienna, Virginia. Approximately a week later, a beaver was found dead at the site and tested positive for rabies (E. Hodnett, Fairfax Virginia Animal Control, pers. comm.).

Beaver activity may also be harmful to other forms of wildlife. While beaver activity does create habitat for a variety of plant and animal species, it also destroys an equal quantity of other habitat types (e.g. free-flowing springs and headwaters, riparian areas, and hardwood bottoms) which are of critical importance to numerous other species. Increased soil moisture in flooded areas can be detrimental to wildlife through decreased bank stabilization, a decrease in mast (e.g., acorn) production and reduced timber growth. As the roots of oaks are saturated and flooded by raised water levels, there is a decrease in growth and mast production followed by death of the tree. The amount of time until the tree is killed varies by species, but is generally only 1-2 years (J. Bassett, Virginia Department of Forestry, pers. comm. 2000).

Beaver dams can negatively impact stream ecosystems and wildlife species that depend on clear and/or flowing water and clean substrates by flooding stream habitats or increasing sedimentation in streams. In most situations, the natural habitat alteration or disturbance caused by beaver would not pose a threat to populations of other species. However, with T&E species, small or isolated populations or habitats may be critical to species survival. In these situations, beaver activity may pose a pronounced threat to the affected species (M. Cantrell, USFWS, pers. comm.). For example, the dwarf wedge mussel (Alasmidonta heterodon), tar spinymussel (Elliptio steinstansana), and Carolina heelsplitter (Lasmigona decorata) commonly reside in small streams and require relatively silt-free flowing water and sand, gravel, or mud substrates. Beaver activity in habitats occupied by these species may cause a degradation of habitat quality (J. Johnson, NCWRC, pers. comm.; M. Cantrell, USFWS, pers. comm.; USFWS 1999). Other T&E species or critical habitats that can be negatively affected by beaver activity include appalachian elktoe (Alasmidonta raveneliana), dwarf-flowered heartleaf (Hexastylis naniflora), small-anthered bittercress (Cardimine micranthera), bunched arrowhead (Sagittaria fasciculata), swamp pink (Helonias bullata), green pitcher-plant (Sarracenia oreophila), mountain sweet pitcher-plant (Sarracenia rubra jonesii), spawning and larval habitats of Cape Fear shiner (Notropis mekistocholas) and spotfin chub (Cyprinella monacha), red-cockaded woodpecker nesting habitat (Picoides borealis), and larval habitat of Saint Francis' satyr butterfly (Neonympha mitchellii francisci) (Mark Cantrell, USFWS, pers. comm.). Patterson (1951) and Avery (1992) reported that the presence of beaver dams can negatively affect fisheries.

NCWS conducted beaver damage management to protect the dwarf wedge mussel (J. Johnson, NCWRC, pers. comm.), and Louisiana WS conducted beaver damage management activities to protect the Louisiana pearlshell

(Margaritifera hembeli) (D. LeBlanc, USDA/APHIS/WS, pers. comm.).

Surveys in North Carolina and Alabama indicate that the majority of landowners with beaver damage on their property desire damage management via beaver removal (Hill 1976, Lewis 1979, Woodward et al. 1985). Loker et al. (1999) found that suburban residents may also desire lethal management methods to resolve beaver damage conflicts. Such conflicts, which are viewed as "damage," result in adverse impacts that often outweigh benefits (Miller and Yarrow 1994).

1.2.3 Beneficial And Detrimental Aspects Of Muskrat And Nutria Activities

Muskrats and nutria are valuable fur resources. In 1982-83, the economic value of muskrat fur harvested in the United States of \$28 million was second only to raccoon. From 1977 to 1984 approximately \$7.3 million worth of nutria fur was harvested in the United States (Boutin and Birkenholz 1987, Kinler 1987). Muskrats and nutria are undoubtedly also valuable to other wildlife species and for providing recreational, educational, and aesthetic benefits.

Economic loss to muskrat damage can be very high in some areas, particularly in aquaculture producing areas. In some states damage may be as much as \$1 million per year (Miller 1994). Elsewhere, economic losses related to muskrat damage may be limited and confined primarily to burrowing in pond dams or other structures. In such cases of limited damage, the value of the muskrat population may outweigh the cost of the damage.

Muskrats dig burrows into high banks, pond dams, and ditch banks for dens, and much of the damage caused by muskrats is related to their burrowing activity (Miller 1994, Linzey 1998, Perry 1982). Muskrats dig burrows with underwater entrances along the shoreline and burrowing may not be readily evident until serious damage has occurred. When water levels drop the burrows are expanded to keep pace with the retreating water level. When water levels rise muskrats expand the burrows upward. Burrows can collapse when walked upon by people or animals and crossed over with heavy equipment (i.e., mowers, tractors). Tractors have rolled over when the ground has given way while maintaining outfall ditches (J. Kertesz, City of Hampton Virginia, pers. comm.). Burrows can also lead to or worsen erosion problems and can compromise the integrity of dams and cause washouts (Perry 1982, Wade and Ramsey 1986).

Muskrats also cause damage by feeding on a variety of natural aquatic vegetation and cultivated crops. Some of the cultivated crops eaten by muskrats include corn, alfalfa, carrots, and soybeans (Boutin and Birkenholz 1987, Linzey 1998, Perry 1982). Marsh damage from muskrats is inevitable when areas heavily populated by muskrats are under-trapped (Lynch et al. 1947). When muskrats become overpopulated, an "eat-out" can occur in which feeding areas are ruined for a number of years (O'Neil 1949). An "eat-out" occurs when all or the majority of vegetation, including soil binding roots, is consumed. The loss of vegetation removes food and cover for muskrats and other wildlife. While eat-outs are beneficial to some bird species, they also result in stagnant water which predisposes the same birds to diseases (Lynch et al. 1947).

Muskrats feed on mussels, some of which are listed as federal T&E species. Neves and Odom (1989) reported that muskrats appear to be inhibiting the recovery of endangered mussels and are likely placing pigtoe mussels (Fusconaia masoni) in further jeopardy in the Clinch and Holston Rivers in Virginia. At one site in Virginia, muskrats were known to be feeding on the federally endangered tan riffleshell (Epioblasma f. walkeri), but predation on this species decreased drastically after a muskrat trapping program was implemented (R. Neves, Virginia Polytechnic Institute and State University, letter to M. Lowney, WS, August 4, 1999).

As with muskrats, nutria cause damage by burrowing, feeding on cultivated crops and ornamentals, and overutilizing marsh vegetation. While nutria "eat-outs" can be beneficial to fish, they can also cause permanent marsh loss and replacement by open ponds. Population and habitat management can minimize or eliminate marsh

loss caused by nutria and/or muskrat "eat-outs" (Kinler et al.1987). Nutria damage is often more severe than muskrat damage (Bromley, NCCES, pers. com.).

1.3 NEED AND PURPOSE FOR ACTION

Aquatic rodents cause millions of dollars in damage, distributed among hundreds of landholders, in North Carolina annually. From 1993 to 2000, NCWS received more that 6,984 requests for assistance with aquatic rodent damage problems, with the number of request increasing each year. These landholders reported that from 1993 to 1999 they had lost a minimum of \$34.4 million in resources to aquatic rodent damage (Table 1). NCWS activities from 1993 to 1999 prevented the loss of an additional \$17.3 million in resources to these landholders. The majority of this damage was beaver related. This is a total potential loss over this seven year period, if NCWS aquatic rodent damage management services had not been available, of \$51.7 million in resources or an average potential annual loss of \$7.4 million in resources.

Because of the magnitude and distribution of damage, there is a need to provide North Carolina landholders with an effective and affordable means of protecting their health, property and livelihood from damage caused by aquatic rodents. Since, as discussed in Section 1.1.1., efforts other than the BMAP have generally been unsuccessful in providing adequate assistance to landowners with aquatic rodent damage, and there is only a limited number of experienced professional private trappers and Wildlife Damage Control Agents available to conduct aquatic rodent damage management, North Carolina resource owners and managers need the professional expertise of NCWS for the management of aquatic rodent damage. This need is demonstrated by the number of request for aquatic rodent damage management received by WS over the past eight years.

The purpose of the action will be to provide technical or direct assistance with aquatic rodent damage management to all North Carolina resource owners and managers who request assistance from NCWS. Work will be conducted at the request of resource owners or landholders only, or, when necessary, by permission on adjacent properties. Damage management could be conducted on private, federal, state, tribal, county, and municipal lands throughout the state of North Carolina.

1.4 PROPOSED ACTION

The proposed action is to implement an IWDM approach to reduce or eliminate damage associated with aquatic rodent activities. The program would be geared specifically to assisting North Carolina resource owners and managers with the protection of resources and human health and safety.

An IWDM strategy seeks to preserve and enhance the beneficial aspects of the wildlife species involved, encompasses the use of practical and effective nonlethal and lethal methods of preventing and reducing damage, and minimizes the harmful effects of damage management measures on humans, other wildlife species, and the environment. Under this action, NCWS would provide technical assistance and operational damage management, including nonlethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, water control structures, or habitat modification would be recommended and utilized to reduce aquatic rodent damage. In other situations, aquatic rodents would be removed using: conibear-type traps, snares, foothold traps, colony traps, and shooting. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods would not always be applied as a first response to each damage problem. The most appropriate response may often be a combination of non-lethal and lethal methods, or there may often be instances where application of lethal methods alone would be the most appropriate strategy. All aquatic rodent damage management would be consistent with other uses of the area when practical and feasible.

Table 1. Aquatic rodent damage reported by NC landowners and managers from 1993-1999.

RESOURCE	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	TOTAL	
Timber	0	1,048,715	250,500	3,019,315	2,217,555	3,234,557	2,409,541	12,180,183	
Natural Resources									
(Trees, Watershed etc.)	0	23,000	40,500	11,200	373,336	363,500	249,707	1,061,243	
Field Crops	0	87,235	75,000	204,670	199,001	136,930	169,465	872,301	
Commercial nursery plants	0	0	0	0	35,000	0	0	35,000	
Fruit/Nut Trees	0	7,500	0	30,000	400	0	4,000	41,900	
Pasture/Hayfield	0	760	1500	24,000	5,400	6,700	28,500	66,860	
Dams/Impoundments	0	48,501	25,001	152,500	69,300	51,051	34,100	380,453	
Irrigation/Drainage	0	76,000	1,680,006	186,800	940,472	345,250	169,830	3,398,358	
Fences	0	0	0	0	500	0	0	500	
Aquaculture	0	0	3,000	0	0	0	0	3,000	
Turf/Landscape/Garden	234,000	7,400	13,000	16,700	173,700	65,300	37,600	547,700	
Roads/Bridges	0	74,200	148,102	978,113	870,274	928,222	1,359,339	4,358,250	
Railroad/Trestles	0	0	0	0	0	10,000,000	0	10,000,000	
Utilities	0	1,500	12,500	15,500	329,200	34,000	7,000	399,700	
Airport Runway	0	10,000	0	2,000	1,000	116,000	0	129,000	
Landfills	0	0	0	0	3,000	600 0		3,600	
Equipment	0	0	0	0	0	0 1,500		1,500	
General Property	0	28,000	68,000	103,700	187,702	181,830	96,500	665,732	
Residential Buildings	0	0	0	0	0	30,000	0	30,000	
Non-residential Buildings	0	0	300	0	1,000	0	171,300	172,600	
Human Health & Safety	0 Incidents	4 Incidents	2 Incidents	0 Incidents	4 Incidents	2 Incidents	3 Incidents	15 Incidents	
Recreational Areas	0	0	0	0	6,100	0	0	6,100	
Golf Course	0	0	0	1,000	1,000	5,000	10,000	17,000	
Swimming Pools	0	0	0	0	8,000	0	0	8,000	
TOTAL	234,000	1,412,811	2,317,409	4,745,498	5,421,940	15,498,940	4,748,382	34,378,980	

1.5 OBJECTIVES

1.5.1 To provide technical or direct assistance with aquatic rodent damage management to 100% of North Carolina resource owners and managers who request assistance from NCWS.

1.6 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

- 1.6.1 ADC Programmatic EIS. WS has issued a final EIS (USDA 1997) and Record of Decision on the National APHIS-WS program. This EA is tiered to that EIS.
- 1.6.2 USDA-APHIS-ADC Environmental Assessment for the Management of Beaver Damage to Property and Agricultural Resources in the Piedmont, Sandhills, and Coastal Regions of North Carolina (1996). This is the EA by which NCWS has conducted beaver damage management in North Carolina since 1996. This new EA, "Aquatic Rodent Damage Management in North Carolina" will replace the 1996 document.

1.7 DECISIONS TO BE MADE

Based on the scope of this EA, the decisions to be made are:

• Would the proposed action or the alternative actions have significant environmental impacts, requiring preparation of an EIS?

- Should NCWS implement the proposed action? If so, when and how?
- If not, should NCWS implement one of the alternative actions? If so, when and how?

1.8 RELATIONSHIP OF AGENCIES DURING PREPARATION OF THE EA

The lead agency on this EA is NCWS. T	he
	acted as cooperating agencies and contributed input
throughout preparation of the EA.	acted as cooperating agencies and contributed input

1.9 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

- 1.9.1 Actions Analyzed. This EA evaluates planned aquatic rodent damage management to protect resources and human health and safety in North Carolina. Other program activities will be addressed in other NEPA analysis, as appropriate.
- 1.9.2 Wildlife Species Potentially Protected by NCWS. NCWS assistance may be requested to achieve management objectives for wildlife, including T&E species. If needs are identified, determinations will be made on a case-by-case basis if additional NEPA analysis is needed.
- 1.9.3 American Indian Lands and Tribes. Currently, NCWS does not have agreements with any American Indian tribe. If NCWS enters into an agreement with a tribe for aquatic rodent damage management, this EA would be reviewed and supplemented, if necessary, to insure NEPA compliance.
- 1.9.4 Period for which this EA is Valid. This EA will remain valid until NCWS and other appropriate agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects need to be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. This EA will be reviewed annually and amended or supplemented as necessary.
- 1.9.5 Site Specificity. This EA analyzes the potential impacts of aquatic rodent damage management activities on all private and public lands in North Carolina under Cooperative Service Agreements. It also addresses the impacts of aquatic rodent damage management on areas where additional agreements may be signed in the future. Because the proposed action is to reduce or eliminate damage and the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever aquatic rodent damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) is the site-specific procedure for individual actions conducted by NCWS in North Carolina (see Chapter 3 for a description of the Decision Model and its application).
- 1.9.6 Summary of Public Involvement. Issues related to the proposed action were initially developed by an interdisciplinary team involving team refined the issues and identified preliminary alternatives. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified or have otherwise expressed interest in aquatic rodent damage management activities conducted by NCWS. New issues or alternatives

raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.10 PREVIEW OF THE REMAINDER OF THIS EA

The remainder of this EA is composed of four chapters, five appendices, and attachments. Chapter 2 discusses and analyzes the affected environment and issues. Chapter 3 contains descriptions of aquatic rodent damage management approaches and methods, alternatives, and mitigation and standard operating procedures (SOP). Chapter 4 analyzes consistency with environmental consequences and the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA. Appendix A is literature cited during the preparation of the EA, Appendix B is the authorities for conducting wildlife damage management in North Carolina, Appendix C describes criteria for beaver dam removal, and Appendix D is a detailed description of the methods used for aquatic rodent damage management. The attachments are documents related to this EA.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

2.0 INTRODUCTION

The following narrative defines and discusses: 1) affected environment, 2) primary issues of concern, 3) issues used to develop mitigation measures and Standard Operating Procedures (SOP), and 4) issues not considered in detail.

2.1 AFFECTED ENVIRONMENT

The proposed action will affect private and public lands throughout North Carolina including: agricultural, timber, and other rural lands; residential, commercial and other urban properties; state and federal roads and rights-of-way; railroads and rights-of-way; and lands inhabited by T&E species.

2.2 PRIMARY ISSUES OF CONCERN

The following issues have been identified as areas of concern requiring detailed consideration and analysis in this EA.

- Effects on aquatic rodent species
- Effects on wetland habitats, plants and other wildlife species, including T&E species
- Effects on human and pet health and safety
- Impacts to stakeholders, including aesthetics
- Humaneness

These issues will receive detailed environmental impact analysis in Chapter 4.

2.2.1 Effects on aquatic rodent populations

The management of aquatic rodent damage often involves the removal of individual animals or entire local populations, and it may involve the reduction or management of populations on a regional or statewide level.

Concern 1: The proposed action or any of the alternatives may result in the loss of local aquatic rodent populations or could have a cumulative adverse impact on regional or statewide populations of these species.

Concern 2: The proposed action or any of the alternatives may benefit populations of aquatic rodents by reducing population densities and competition for resources in highly populated areas.

2.2.2 Effects on wetland habitats, plants and other wildlife species, including T&E species

The management of aquatic rodent damage, especially the use of lethal techniques and dam removal, sometimes results in the injury or death of other species or the loss of habitat which is valuable to other species.

Concern 1: The proposed action or any of the alternatives may result in the injury or death of individuals or may adversely impact populations of nontarget plant or animal species, including T&E species. The proposed action or any of the alternatives may result in the loss of wetland habitat which is beneficial to some plant and animal species. Non T&E species which may be adversely impacted directly or indirectly by the proposed action include, but are not necessarily limited to: river otter (Lutra canadensis), raccoon (Procyon lotor), ducks (Aix sponsa, Anas spp.),

Canada geese (Branta canadensis), turtles (Chelydra serpentina, Pseudemys spp.), American alligator (Crocodylus acutus), and cottonmouth (Agkistrodon piscivorus) (Table 2).

Concern 2: As alluded to in sections 1.2.1 and 1.2.2, the proposed action or any of the alternatives may be beneficial to some wetland or aquatic habitats and to plants and animals which would otherwise be killed or displaced by flooding or habitat destruction resulting from aquatic rodent activity. The loss of beaver-created habitat which is valuable to other species is in reality the conversion of beaver-created wetland habitats to previously existing or alternate habitat types which are beneficial to a different set of other species. The proposed action or any of the alternatives may restore habitat that is beneficial to other species. As discussed in section 1.2.3, some mussels may benefit from reduced muskrat predation.

2.2.4 Effects on human and pet health and safety

Some devices (e.g. traps, firearms, and explosives) used to manage aquatic rodent damage are potentially hazardous to humans or pets. In some cases, pets (e.g. domestic dog, *Canis familiaris*) have been captured in traps used for the management of aquatic rodent damage (Table 2).

Concern 1: The proposed action or any of the alternatives may be a threat to public and pet health and safety. In particular, lethal methods of aquatic rodent removal (i.e., trapping and shooting) and explosives may be hazardous to people and pets.

Concern 2: The proposed action or any of the alternatives may protect and enhance public and pet health or safety. Refer to sections 1.2.2 and 1.2.3 for details on the potential threats to human and pet health and safety caused by aquatic rodent populations.

TABLE 2.	NON-TARGET ANIMALS CAPTURED BY WS WHILE CONDUCTING
	AQUATIC RODENT DAMAGE MANAGEMENT FROM 1993-2000

	FY 1993		FY 1994		FY 1995		FY 1996		FY 1997		FY 1998		FY 1999		FY 2000		OVERALL TOTAL	
SPECIES	Freed	Killed	Freed	Killed														
Otter	9	0	1	37	0	43	0	83	0	55	0	53	1	50	1	10	12	321
Raccoon	8	0	1	16	0	13	0	25	2	32	0	12	0	11	0	12	11	109
Alligator	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	0	4	0
Turtles	125	77	85	104	36	26	148	33	127	100	267	93	111	31	67	13	966	464
Dabbling ducks	0	0	0	1	0	3	0	3	0	3	0	0	0	1	0	0	0	11
Canada geese	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	3
Cottonmouth	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	2
Dog	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	4	0
YEARLY TOTAL	142	77	87	159	37	85	148	145	130	191	273	160	113	93	68	35	998	910

2.2.5 Impacts to stakeholders, including aesthetics

Public reactions to wildlife damage management are variable because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions regarding the best ways to manage conflicts between humans and wildlife. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. A percentage of the American public considers individual wild animals as "pets" or exhibits affection toward these animals. Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987), including direct benefits derived from a user's personal relationship to animals (e.g., wildlife-related recreation, observation, harvest, or sale), and indirect benefits which arise without the user being in direct contact with the animal. Indirect benefits are

derived from vicarious wildlife related experiences (e.g., reading or television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, and bequest values) (Bishop 1987). Direct benefits may take the form of consumptive use (e.g. harvest or sale) or non-consumptive use (e.g. viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987).

The management of aquatic rodent damage sometimes displaces or reduces economic, recreational, educational or aesthetic benefits which could potentially be derived from aquatic rodents.

Concern 1: The proposed action or any of the alternatives may result in the loss of economic, recreational, educational or aesthetic benefits to the public, resource owners, or neighboring residents.

Concern 2: The proposed action or any of the alternatives may result in an increase of alternative benefits, including alternative economic, recreational, educational or aesthetic benefits.

2.2.6 Humaneness

Humaneness is expressing what are considered by humans to be the best qualities of human beings (e.g. kindness, tenderness, mercy, and sympathy) within the framework of human social organization. In other words, to be humane is to be civilized (Neufeldt and Guralnik 1988). Since, by definition, humaneness refers primarily to interactions between humans, and the application of the term to interactions between humans and animals is secondary, the issue of humaneness must address the affects of aquatic rodent damage management on humans at least as much as it addresses the affects on animals. Additionally, humaneness must address not only the affects of management strategies and methods, but also the affects of management compared to the affects of nonmanagement. For example, without management, aquatic rodents may cause mental or physical pain or suffering, or even death, to humans. Without management, death, pain or other forms of unhealthiness may occur in aquatic rodent populations or populations of other animals at a higher rate than with management. Management that causes death, may contribute to the maintenance of healthy populations (Robinson and Bolen 1984,).

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if "... the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."

Suffering is described as a "...highly unpleasant emotional response usually associated with pain and distress." However, suffering "... can occur without pain ... " and "... pain can occur without suffering ... " (AVMA 1986). Because suffering carries with it the implication of a time frame, a case could be made for "... little or no suffering where death comes immediately ... " (CDFG 1991), such as shooting.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and causes that elicit pain responses in humans would "... probably be causes for pain in animals..." (AVMA 1986). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991).

Pain and suffering, as it relates to WS damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since "... neither medical or veterinary curricula explicitly address suffering or its relief" (CDFG 1991).

Research suggests that with some methods, such as restraint in foothold traps, changes in the blood chemistry of trapped animals indicate "stress" (USDA 1997: 3-81). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The AVMA states "... euthanasia is the act of inducing humane death in an animal." and "... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness." (Andrews et al 1993).

Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild and feral animals. The AVMA states that "For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible." (Andrews et al 1993).

The decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals but also the welfare of humans if damage management methods were not used. Humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of human and animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some wildlife damage management methods are used. North Carolina WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures/Standard Operating Procedures (SOP) used to maximize humaneness are listed in Chapter 3.

Some people consider drowning inhumane and are concerned about aquatic rodents that drown while restrained by foothold traps. There is considerable debate and disagreement among animal activists, some veterinarians, wildlife professionals, fur trappers, and nuisance wildlife control specialists on this issue. The debate centers around an uncertainty as to whether the drowning animals are rendered unconscious by high levels of CO2 and are thus insensitive to distress and pain. (Ludders et al. 1999). The AVMA identifies drowning as an unacceptable method of euthanasia (Andrews et al. 1993), but provides no literature citations to support this position. Ludders et al. (1999) concluded drowning is not euthanasia based on the animals not dying from CO2 narcosis. They reported CO2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded and showed that death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia. They concluded that animals that drown are distressed because of stress related hormones, epinephrine and norepinephrine, and therefore drowning is not euthanasia.

Carbon dioxide (CO₂₎ causes death in animals by hypoxemia and some animals (cats, rabbits, and swine) are distressed before death (Andrews et al. 1993). Even though these animals are distressed, the AVMA (Andrews et al. 1993) states this death is an acceptable form of euthanasia. Thus, the AVMA does not preclude distress or pain in euthanasia. In fact, the AVMA supports inducing hypoxemia related distress when necessary to reduce total distress, because reducing total distress is a more humane death.

Death by drowning in the classical sense is caused by the inhalation of fluid into the lungs and is referred to as "wet" drowning (Gilbert and Gofton 1982, Noonan 1998). Gilbert and Gofton (1982) reported that all submerged beaver do not die from wet drowning, but die of CO2 induced narcosis, and the AVMA has stated the use of CO2 is acceptable. However, Gilbert and Gofton (1982) have been criticized because levels of carbon dioxide in the blood were not reported (Ludders et al. 1999) and there was insufficient evidence that the beaver in their study were under

a state of CO₂ narcosis when they died (V. Nettles, Southeastern Cooperative Wildlife Disease Study, letter to W. MacCallum, Massachusetts Division of Fisheries and Wildlife, June 15, 1998). Adding to the controversy, Clausen and Ersland (1970) did measure CO₂ in the blood for submersed restrained beaver, yet none of the beaver in their study died, so Clausen and Ersland (1970) could not determine if beavers die of CO₂ narcosis. Clausen and Ersland (1970) demonstrated that CO₂ increased in arterial blood while beaver were submersed and CO₂ was retained in the tissues, but they did not attempt to measure the analgesic effect of CO₂ buildup to the beaver (letter from V. Nettles, D.V.M., Ph.D., Southeastern Cooperative Wildlife Disease Study to W. MacCallum, MA Division of Fisheries and Wildlife, June 15, 1998).

When beaver are trapped using foothold traps with intent to "drown", the beaver are exhibiting a flight response. Gracely and Sternberg (1999) report that there is stress-induced analgesia resulting in reduced pain sensitivity during fight or flight responses. Environmental stressors that animals experience during flight or fight activate the same stress-induced analgesia (Gracely and Sternberg 1999).

The use of drowning trap sets has been a traditional wildlife management technique in trapping aquatic rodents. Trapper education manuals and other wildlife damage management manuals written by wildlife biologists recommend drowning sets for foothold traps set for beaver (Boggess and Loegering, Bromley et al. 1994, Dolbeer et al. 1994, Howard et al. 1980, Miller and Yarrow 1994, Randolph 1988). In some situations, drowning trap sets are the most appropriate and efficient method available to capture aquatic rodents. For example, a drowning set attachment should be used with foothold traps when capturing beaver to prevent the animal from injuring themselves while restrained, or from escaping (Miller and Yarrow 1994). Animals that drown die relatively quickly (ie., within minutes) versus the possible stress of being restrained and harassed by people, dogs, and other wildlife before being euthanized. Drowning sets make the captured animal and trap less visible and prevent human injury (i.e., bites and scratches) to people who may otherwise approach a restrained animal. Furthermore, some people are offended seeing trapped animals, weather live or dead, and drowning takes the dead animal out of public view. Some sites may be unsuitable for conibear-type traps or snares because of unsuitable banks or deep water but may be suitable for foothold traps. In some situations where muskrats occur in high densities, multiple catch colony traps may be the most efficient method to reduce populations and alleviate damage, and drowning is a humane way of killing muskrats (Gilbert and Gofton 1982) in colony traps.

Given the short time period of a drowning event, the possible analgesic effects, the AVMA's acceptance of hypoxemia as euthanasia and the AVMA's acceptance of a minimum of pain and distress during euthanasia, the acceptance of catching and drowning muskrats approved by International Humane Trapping Standards (Fur Institute of Canada 2000), we conclude that drowning is acceptable. We recognize some people will disagree and are unswayed.

The AVMA (Andrews et al. 1993) states, "Kill traps are practical and effective for animal collection when used in a manner that minimizes the potential for attraction and collection of non-target species." It appears the AVMA accepts the use of kill traps. In addition, the American Society of Mammalogists recommends using kill traps for medium-sized animals in field investigations (Baker et al. 1987). Also, conibear-type traps have passed the International Humane Trapping Standards for beaver and muskrat (Fur Institute of Canada 2000).

In May 2000, the Canadian government determined standard and modified 330 Conibear traps met the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000) for beaver. They also determined that foothold traps with a submersion system, 110 Conibear traps in water and 120 Conibear traps on land met the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000).

In summary, the Canadian government has determined that standard and modified 330 Conibear traps, 110 and 120 Conibear traps, and foothold traps on submersion systems met international humane trapping standards, the

American Society of Mammologists recommended kill traps for medium-sized animals, and the AVMA is not opposed to kill traps for wildlife.

The management of aquatic rodent damage sometimes results in aquatic rodents and other animals experiencing pain and death.

Concern 1: The proposed action or any of the alternatives may reduce suffering, pain, stress and death which is inflicted on humans by aquatic rodents.

Concern 2: The proposed action or any of the alternatives, in particular the use of foothold traps and drowning, may result in unnecessary, unfair, or unjustifiable suffering, pain or stress being inflicted on aquatic rodents or other animals.

Concern 3: The proposed action or any of the alternatives may consider the good of the majority (ie. the population as a whole) rather than the select few (ie. individual animals) and may result in reduced suffering, pain, stress and the improved well-being of the greatest number of individuals.

2.3 ISSUES USED TO DEVELOP MITIGATION MEASURES

All of the primary issues of concern discussed in section 2.3 were used in the development of mitigation measures. The following additional issues were also used.

- The National Historic Preservation Act of 1966, The Native American Graves and Repatriation Act of 1990
- The Environmental Justice and Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"
- The Protection of Children from Environmental Health and Safety Risks (Executive Order 13045).

2.3.1 The National Historic Preservation Act of 1966, The Native American Graves and Repatriation Act of 1990

The National Historic Preservation Act of 1966, as amended, requires federal agencies to evaluate the effects of any federal undertaking on cultural resources and to consult with appropriate American Indian Tribes to determine whether they have concerns for cultural properties in areas of these federal undertakings. The Native American Graves and Repatriation Act of 1990 provides for protection of American Indian burial sites, human remains, funerary and sacred objects, and establishes procedures for notifying Tribes of any new discoveries.

In most cases, beaver, nutria or muskrat damage management has little potential to cause adverse effects to sensitive cultural resources. The areas where damage management would be conducted are small and pose minimal ground disturbance. The North Carolina Department of Cultural Resources will review the program as proposed and is expected to conclude that the aquatic rodent damage management program, "does not have the potential to cause effects on historic properties. Mitigation to avoid impacts to are listed in Chapter 3.

2.3.2 Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"

Environmental Justice (EJ) has been defined as the pursuit of equal justice protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Fair treatment implies that no person or group should endure a disproportionate share of the negative environmental impacts resulting from this country's domestic and foreign policies or programs.

Executive Order 12898 requires federal agencies to make EJ part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low-income persons or populations. APHIS plans to implement Executive Order 12898 principally through the provisions of NEPA.

2.3.3 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately from environmental health and safety risks for many reasons, including their physical and mental developmental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionally affect children, WS has considered the impacts that this proposal might have on children. The proposed aquatic rodent damage management would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action. In contrast, WS aquatic rodent damage management may provide for a safer environment for children by reducing public health and safety risks.

2.4 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.4.1 NCWS aquatic rodent damage management activities may impact biodiversity

NCWS aquatic rodent damage management is not conducted to eradicate a native wildlife population, but rather seeks only to alleviate specific damage problems in relatively small, confined areas via nonlethal techniques or lethal removal of a limited number of specific damaging animals. NCWS uses an IWDM strategy which seeks to preserve and enhance the beneficial aspects of the wildlife species involved and minimizes the harmful effects of damage management measures on other wildlife species and the environment. NCWS operates according to international, federal, and state laws and regulations enacted to ensure species viability. The impacts of the current NCWS program on biodiversity are minor and not significant nationwide, statewide, or regionwide (USDA 1997).

2.4.2 Wildlife damage management should not be at taxpayer expense; wildlife damage management should be fee based

WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the United States. Federal, state, and local officials have decided that wildlife damage management should be conducted and have appropriating funds for aquatic rodent damage. In North Carolina, funding comes from federal, state, county, municipal, and private sources. Wildlife damage management is an appropriate sphere of activity for government programs, since aspects of wildlife damage management are a government responsibility and authorized and directed by law.

2.4.3 Aquatic rodent damage should be managed by trappers and nuisance wildlife control agents; NCWS may compete with private enterprise

The jurisdiction for managing resident wildlife in North Carolina rests with the North Carolina Wildlife Resources Commission (NCWRC). Currently, the NCWRC manages beaver, muskrats, and nutria as furbearers, and all three species may be harvested for fur during the regular trapping season. Beaver may be trapped year-around for damage management purposes without a permit, and muskrat and nutria may be trapped year-around for damage management purposes with a permit. All aquatic rodents may be shot year-around for damage management purposes without a permit, and beaver and nutria may also be hunted for sport with no closed season or bag limit. Through season, bag limit, and trapping method regulations, North Carolina has utilized private fur trapping as a

tool in aquatic rodent population management. Regulated beaver trapping seasons have occurred in North Carolina since 1963 (Woodward et al. 1995).

Recreational fur trappers provide several societal services, including trapping beaver causing damage to property and assisting the NCWRC in manage beaver populations. However, the number of recreational fur trappers in North Carolina has drastically declined in the past decade, with only several hundred beaver being harvested per year (Woodward et al. 1995, P. Sumner, NCWRC, pers. comm.). According to beaver harvest data from the NCWRC, the number of trapping licenses sold annually decreased 90% over the past 20 years from 6,704 licenses in 1979-80 to 733 in 2000-01 (P. Sumner, NCWRC, pers. comm.). Some causes for the decline in recreational trapping have been lower prices paid for fur since the early 1980's, cultural changes, and the consequent insufficient number of trappers to manage the expanding beaver population. In addition, the legal fur trapping season for beaver lasts for only 5 months of the year, while beaver damage problems occur year-round. Many beaver damage problems also occur in urban or developed areas where little or no recreational beaver trapping occurs.

Trappers and Wildlife Damage Control Agents (WDCA) are allowed to conduct aquatic rodent damage management, and when requested, NCWS provides landowners or private trappers with training so they can conduct aquatic rodent damage management on their property or for others. Private trappers, WDCA's, and landholders can trap or shoot aquatic rodents to alleviate damage as outline above. However, in 1996, 1997, 1998 and 1999, only 49 WDCA's reported doing aquatic rodent damage management work and these agents only reported doing 48, 58, 79. and 47 jobs during these years, respectively. During these same years, North Carolina state certified WDCA's reported removing only 100, 93, 140, and 155 beaver, respectively, 29, 142, 132, 335 muskrats, respectively, and 0, 0, 0, and 1 nutria, respectively, for damage management purposes (Sumner, Unpub. Data). Data for 2000 was not available at the time this document was prepared. During these same years, NCWS received 944, 1,021, 1,028, and 1,117, respectively, requests for assistance with beaver damage management and removed 4,684, 4,624, 4,475, and 4,562 beaver, respectively. Apparently, WDCA's are not willing and/or able to provide aquatic rodent damage management services throughout the state on a year round basis. Some trappers may not be willing to trap in urban areas for aesthetic reasons or for fear of trap theft. Trappers also may not be willing to trap aquatic rodents outside of the regular trapping season because the furs have little or no economic value and cannot be utilized. Further, few private trappers have the training and expertise that BMAP Wildlife Specialists have to use explosives to remove beaver dams causing flooding. Nevertheless, aggressive and hardworking private aquatic rodent damage management agents are able to earn a reasonable living in North Carolina, even in counties where NCWS conducts full-time beaver damage management activities.

Site-specific damage management is necessary to protect property, roads, bridges, and agricultural and natural resources. NCWS has the infrastructure available throughout the state to rapidly respond to emergencies such as beaver-flooded roadways, water treatment facilities and homes, and beaver-borne transmission of human diseases such as rabies and giardia. It is the policy of NCWS to provide professional damage management upon request and verification of damage at site-specific locations. However, NCWS employees will not knowingly provide service to a landowner at the same time a private trapper is on the property. If a landowner would like to allow private trappers access to their property during the trapping season, NCWS employees will remove their trapping equipment and only return at the request of the landowner. As mentioned above, NCWS also seeks to cooperate with and provide training and other technical assistance to private WDCA's.

NCWS conducts full-time aquatic rodent damage management activities because North Carolina residents and the have asked county, state, and federal governments for help in dealing with ever increasing problems caused by beaver. With few private trappers available, the needs of the public were not being met. Wildlife is a publicly owned natural resource, and State and Federal governments are responsible for maintaining healthy, stable wildlife populations. When wildlife causes damage or poses a threat to human health and safety, government has an obligation to respond to requests for assistance. In the vast majority of cases, NCWS and private trappers have a healthy working relationship throughout North Carolina. There are private wildlife

damage control businesses in North Carolina who are successful partly because they have cultivated a close working relationship with NCWS. NCWS routinely refers work to private nuisance wildlife control companies. An indication of this strong working relationship between NCWS and private trappers is the fact that the NCWS has support from the North Carolina Trappers Association, an organization that represents private trappers throughout the State.

Some landowners may prefer that a government agency manage aquatic rodent damage instead of private WDCA's, and large landowners with numerous damage sites (i.e., railroads or highway departments) may prefer to use NCWS because of reduced administrative burden and liability concerns. Some landowners may prefer to use private trappers or nuisance wildlife control agents instead of NCWS. Thus, NCWS aquatic rodent damage management activities can not eliminate opportunities for private trappers or WDCA's. In fact, opportunities for private operators may be increased through training, technical support, and referrals.

2.4.8 Aquatic Rodents Removed by NCWS Will Be Wasted or Disposed of in an Unsanitary Manner

Beaver are a renewable natural resource and are utilized by NCWS whenever possible. In past years, when demand for beaver pelts was higher, beaver were sold to fur buyers and the money returned to the NCWS program. In recent years demand has been low making transport and storage of beaver not cost effective. Beaver removed on private lands are offered to the landowner, or when practical or feasible, donated to universities, schools, or museums for educational needs or other purposes. Beaver have been saved for research studies at NC State and Duke University and will be saved for a genetics study conducted by USDA's National Wildlife Research Center. If no one wants the beaver carcass it is usually disposed of on site. NCWS employees make every reasonable effort to dispose of beaver carcasses in a manner which demonstrates recognition of public sensitivity towards the viewing of dead animals. Beaver trapped along highway rights-of-ways are removed and transported to a suitable location for disposal in a sanitary manner. In the past, some carcasses were transported to dead boxes where they were disposed of by commercial operators. Commercial operators, who charge a fee for this service, are inspected by state and federal regulators to ensure that the processing of such carcasses does not result in transmission of disease. Because of recent changes in regulations, commercial operators no longer accept wildlife carcasses, and this practice has been discontinued.

17. A bounty system would be more effective at solving beaver problems

Bounty trapping seldom, if ever, solves an individual's problem since bounty trappers do not necessarily target beaver that are causing damage. Bounty trappers generally target those beaver which are easiest to catch. Beaver are usually left behind because it is not worth the time to continue. Leaving even one beaver behind will not alleviate flooding problems because that beaver will continue to maintain the dams that cause the flooding. The few North Carolina counties that tried a bounty system saw no reduction in the number of beaver complaints. In the mid 1990's Sampson County had a \$15/beaver tail bounty, but found the system was easily abused with many of the beaver tails turned in coming from outside the county. They have since stopped such a bounty system. Some individuals may prefer a bounty system since, while it will not resolve beaver problems, it may be profitable to some private trappers.

2.4.9 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area

Some individuals might question whether preparing an EA for an area as large as the entire state of North Carolina would meet the NEPA requirements for site specificity. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EA's covering smaller zones. If a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared.

CHAPTER 3 ALTERNATIVES

3.0 INTRODUCTION

This chapter consists of the following seven parts: 1) introduction, 2) aquatic rodent damage management approaches used by NCWS, 3) aquatic rodent damage management methods used or recommended by NCWS, 4) methodologies considered but deemed impractical, ineffective or unsafe at the present time, 5) alternatives considered in detail including the Proposed Action (Alternative 1), 6) alternatives considered but eliminated from detailed analysis, and 7) mitigation measures and SOPs for aquatic rodent damage management. Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), "Methods of Control" (USDA 1997 Appendix J) and the "Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program" (USDA 1997, Appendix P) of USDA (1997). Five alternatives were recognized, developed, and analyzed in detail by the Multi-agency Team alternatives were considered but not analyzed in detail.

3.1 AQUATIC RODENT DAMAGE MANAGEMENT APPROACHES USED BY NCWS.

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife (USDA 1997). During more than 80 years of resolving wildlife damage problems, WS has considered, developed, and used numerous methods of reducing wildlife damage (USDA 1997). WS's efforts have involved the research and development of new methods, and the implementation of effective strategies to resolve and prevent wildlife damage.

3.1.1 Integrated Wildlife Damage Management

Usually, the most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention

and reduction of damage caused by wildlife based on local problem analyses and the informed judgement of trained personnel. The WS Program applies IWDM, (WS Directive 2.105), to reduce damage through the WS Decision Model (Slate et al. 1992) discussed in section 3.1.4.

The philosophy behind IWDM is to implement effective management techniques in a cost-effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques for specific situations. IWDM may incorporate cultural practices, habitat modification, animal behavior modification, removal of individual animals, local population reduction, or any combination of these or other methods, depending on the characteristics of a specific damage problem.

3.1.2 Education and Technical Assistance

Education is an essential element of NCWS program activities because effective wildlife damage management involves learning to find balance between the needs of people and needs of wildlife. NCWS educational efforts include the routine dissemination of recommendations, leaflets regarding aquatic rodent biology, ecology and damage management, and other information to individuals or organizations sustaining damage. NCWS also provides lectures, workshops, demonstrations and other educational or instructional programs to farmers, homeowners, youth

groups and other interested parties. NCWS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

Technical assistance is limited to providing advice, literature and educational or instructional programs. Technical assistance covers wildlife habits, biology, habitat requirements, interactions with other wildlife species, and damage; aesthetic, recreational or other values; management philosophies; habitat management strategies and techniques; animal behavior modification strategies and techniques; and the proper use of conibear-type traps, foothold traps, snares, tree guards, water-level management devices and other damage management techniques. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on several factors including need and practical application. Technical assistance may require substantial effort by NCWS personnel in the decision making process, but the implementation of management techniques is the responsibility of the requesting party.

3.1.3 Operational Damage Management

Operational damage management includes all management activities that are actually conducted by NCWS personnel. Operational damage management is implemented when the problem cannot be resolved through technical assistance and/or the cooperator requests additional assistance. An initial investigation explores and defines the nature and history of the problem, extent of damage, and the species responsible for the damage. NCWS then considers the biology and behavior of the damaging species, and other factors using the WS Decision Model (Slate et al. 1992). The recommended strategy(ies) may include any combination of preventive actions, generally implemented by the property owner, and corrective actions, generally implemented by NCWS. Corrective damage management involves the application of non-lethal and lethal management techniques to reduce or eliminate losses,

as requested and appropriate. The professional skills of WS personnel are often required to resolve problems effectively and safely, especially when specialized techniques are required or when the problem requires the direct supervision of a wildlife professional.

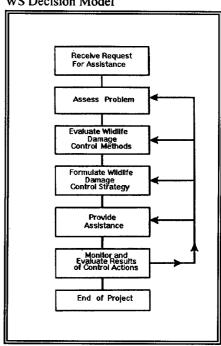
3.1.4 WS Decision Making

The procedure used by WS personnel to determine the management strategies or methods to apply to a specific damage problem can be found in USDA (1997 Appendix N).

The WS Decision Model (Figure 3-1) considers the following factors before selecting or recommending damage management methods and techniques:

- Species responsible for the damage
- Magnitude, geographic extent, frequency, history and duration of the problem
- Status of target and non-target species, including T&E species
- Local environmental conditions
- Potential biological, physical, economic, and social impacts
- Potential legal restrictions

Figure 3-1 WS Decision Model



Costs of damage management option¹

The decision making process is a procedure for evaluating and responding to damage complaints. NCWS personnel are frequently contacted after requesters have tried various techniques and found them to be inadequate for reducing damage to an acceptable level. NCWS personnel assess the problem and evaluate methods for their availability (legal and administrative) and suitability based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical and effective for the situation are formed into a management strategy. After the management strategy has been implemented, the strategy is monitored and evaluated to assess effectiveness. If the strategy is effective, the present need for management is satisfied.

When damage continues intermittently over time, NCWS personnel and the requester monitor and reevaluate the situation. If a strategy fails to stop damage, a different strategy is implemented. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of a continuous feedback loop between receiving the request and monitoring the results, with the damage management strategy reevaluated and revised periodically as necessary.

3.1.5 Technical assistance provided by NCWS to resource owners for decision making

NCWS follows the "Co-managerial approach" to solving wildlife damage as described by Decker and Chase (1997), by providing technical assistance regarding the biology and ecology of aquatic rodents and effective, practical, and reasonable non-lethal and lethal methods of damage management to local decision makers. Technical assistance regarding the alleviation of aquatic rodent damage is also available from NCWRC and NCCES. NCWS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions and make recommendations at local community meetings when resources are available. Resource owners and managers directly affected by aquatic rodent damage in NC have direct input into the resolution of such problems. They may implement management recommendations provided by NCWS or others, or may request management assistance from NCWS, other wildlife management agencies, local animal damage management agencies, or private businesses.

Local decision makers have the final decision as to which available methods will be used to solve wildlife-human conflicts. These decisions may be made based on a comparison of benefits versus damage or the cost of implementing each management strategy. Local decision makers include community, county, town and city leaders and resource owners or managers

3.2 AQUATIC RODENT DAMAGE MANAGEMENT METHODS USED OR RECOMMENDED BY NCWS

USDA (1997 Appendix J) describes methods currently used by the NCWS program. Several of these were considered in this assessment because of their potential use in reducing aquatic rodent damage and threats to human health and safety. More detailed descriptions of these methods are found in Appendix D.

3.2.1 Non-lethal Aquatic Rodent Damage Management Methods:

1

Habitat Modification generally refers to the removal or manipulation of riparian and aquatic vegetation to eliminate aquatic rodent food resources and reduce the carrying capacity for aquatic rodents. Habitat management may also involve the application of riprap or other methods to prevent borrowing and reduce habitat suitability.

Habitat modification may also involve the use of Water-Level Management Devices to reduce damage caused by

^{1.} The cost of management may sometimes be secondary because of overriding environmental, legal, public health and safety, animal welfare or other concerns.

flooding. Water-level management devices are also utilized as a means of exclusion at road culverts.

Exclusion involves the use of specialized devices, such as tree guards, fencing and grit paint, to prevent aquatic rodents from gaining access to protected resources.

Beaver Dam Removal is accomplished either with the use of binary explosives or manually.

3.2.2 Lethal Damage Management Methods:

These methods are used for damage management specifically designed to lethally remove aquatic rodents in certain situations to stabilize, reduce, or eliminate damage. The level of removal necessary to achieve a reduction of damage varies according to the resource protected, habitat, species population, the effectiveness of other damage management strategies, and other factors.

Shooting is selective for the target species and may involve the use of a spotlight and a shotgun, rifle or pistol.

Conibear-type traps are extremely effective capture devices designed to cause the quick death of captured animals. Proper trap size, adjustment and placement and the selection and placement of appropriate lures allow trained professionals to achieve the maximum effectiveness and selectivity from these traps. Non-target species captured in conibear-type traps are usually killed quickly by the trap when captured and usually can not be released.

Foothold traps are also extremely effectively for capturing aquatic rodents. Proper trap size, adjustment and placement and the selection and placement of appropriate lures allow trained professionals to achieve the maximum effectiveness and selectivity from these traps. Although aquatic rodents can be live-captured using foothold traps, they are usually killed. Sometimes, drowning sets are used for foothold traps. Non-target species captured in foothold traps can usually be released unharmed if drowning sets are not used.

Snares are extremely effective, specialized traps consisting of a cable loop, swivel and locking mechanism. Aquatic rodents captured in snares are usually held alive and unharmed by the device. Although aquatic rodents can be live-captured using snares, captured animals are usually killed. Non-target species captured in snares are usually released unharmed.

Colony traps are multiple catch devices used to capture muskrats. Although muskrats can be live-captured using colony traps, captured animals are usually killed.

Hancock traps (suitcase/basket type cage traps) are designed to live-capture beaver. One advantage of using the Hancock trap is that beaver or non-target animals can often be released. Beaver caught in Hancock traps could also be killed. Disadvantages are that these traps are very expensive (approximately \$275 per trap), cumbersome, and difficult to set (Miller and Yarrow 1994). The trap weighs about 25 pounds and is relatively bulky to carry and maneuver. Hancock traps can also be dangerous to set (hardhats are recommended when setting suitcase traps), are less cost and time-efficient than snares, footholds, or conibear-type traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999). Nevertheless, it is possible that Hancock traps could be used in specialized situations.

3.3 METHODOLOGIES CONSIDERED BUT DEEMED IMPRACTICAL, INEFFECTIVE, OR UNSAFE AT THE PRESENT TIME:

3.3.1 Harassment Activities - Harassment has generally proven ineffective in reducing aquatic rodent damage problems (Jackson and Decker 1993). Destroying beaver dams and lodges without removing resident beaver rarely resolves damage problems as beaver usually rebuild in the same vicinity in a very short time. Also, removal of food

supplies to discourage aquatic rodent activity is generally not feasible nor ecologically desirable.

- 3.3.2 Repellents No effective repellents are registered for aquatic rodent damage management. However, recent research from the USDA, APHIS, WS, National Wildlife Research Center has suggested that painting trees with a mixture of 1 quart of sand to 1 gallon of exterior latex paint may prevent beaver from gnawing and cutting the painted trees. If this method is found to be effective and practical, and if it is classified as a "repellent" requiring registration under the FIFRA and state pesticide control laws, then NCWS would consider and use or recommend this repellent method once registered. In the meantime, we have classified this method as exclusion and have discussed it in section 3.2.1.
- 3.3.3 Toxicants No toxicants are registered for aquatic rodent damage management in North Carolina.
- 3.3.4 Reproduction control A review of research evaluating chemically and surgically induced reproductive inhibition as a method for controlling nuisance beaver populations is contained in Novak (1987a). Although these methods were effective in reducing beaver reproduction by up to 50%, the methods were not practical or were too expensive for large-scale application. Additionally, reproductive control does not alleviate current damage problems (Organ et al. 1996). Currently, no chemical reproductive inhibitors are legal for the species covered by this EA.
- 3.3.5 Bounties or payment of funds for killing animals suspected of causing economic losses is not supported by NCWS because
 - bounties are generally not effective in managing wildlife or reducing damage,
 - circumstances surrounding take of animals is largely unregulated,
 - no process exists to prohibit taking of animals from outside the damage management area for compensation purposes, and
 - NCWS does not have the authority to establish a bounty program.

3.4 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION (Alternative 1)

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

3.4.1 Alternative 1. Fully Integrated Aquatic Rodent Damage Management for all Private and Public Land (No Action and Proposed Action)

Alternative 1 is the No Action Alternative and the Proposed Action. The No Action Alternative/Proposed Action is to continue the current NCWS aquatic rodent damage management program.

An IWDM approach would be used to reduce damage associated with aquatic rodent activity. IWDM seeks to preserve and enhance the beneficial aspects of the wildlife species involved, encompasses the use of practical and effective nonlethal and lethal methods of preventing and reducing damage, and minimizes the harmful effects of damage management measures on humans, other wildlife species, and the environment. Under this action, NCWS would provide technical assistance and operational damage management, including nonlethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, water control structures, or habitat modification would be recommended and utilized to reduce aquatic rodent damage. In other situations, aquatic rodents will be lethally removed using conibear-type traps, snares, foothold traps, colony traps, and shooting. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods would not always be applied as a first response to each damage problem. The most appropriate response may often be a combination of non-lethal and lethal methods, or there may

often be instances where application of lethal methods alone would be the most appropriate strategy. Damage management would be conducted on public and private property throughout North Carolina only when resource owners or managers request assistance to alleviate aquatic rodent damage or upon agreement of resource owners when necessary to assist adjacent resource owners or managers.

3.4.2 Alternative 2. Only Lethal Aquatic Rodent Damage Management

Under this alternative, only lethal aquatic rodent damage management would be provided by NCWS. NCWS would provide both technical and operation assistance related to lethal damage management. Requests for information regarding non-lethal management approaches would be referred to the NCWRC or private wildlife damage management agents. Resource owners or managers might choose to implement NCWS lethal recommendations, implement non-lethal methods or other methods not recommended by NCWS, contract for NCWS damage management services, use contractual services of private businesses, use volunteer services, or take no action. NCWS damage management services would be conducted as authorized by various federal and state regulations and would be cooperatively funded. NCWS technical assistance would be funded through WS appropriations. This alternative would not allow NCWS to consider the use of habitat modification, physical exclusion, water-level control devices, or beaver dam removal even where these non-lethal methods may be beneficial. Lethal methods used by NCWS would include shooting and trapping.

3.4.3 Alternative 3 - Non-lethal Aquatic Rodent Damage Management

Under this alternative, only non-lethal management approaches would be used or recommended by NCWS. Both technical assistance and operational damage management services would be provided. NCWS technical assistance would be funded through WS appropriations. Requests for lethal wildlife damage management services would be referred to the NCWRC or private Wildlife Damage Control Agents. Resource owners or managers might choose to implement NCWS non-lethal recommendations, implement lethal methods or other methods not recommended by NCWS, contract for NCWS damage management services, use contractual services of private businesses, use volunteer services, or take no action.

3.4.4 Alternative 4 - Technical Assistance Only

This alternative would only allow NCWS to provide technical assistance to individuals or agencies requesting aquatic rodent damage management in North Carolina. However, private landowners, contractors, or others could conduct their own damage management on federal, state, county, and private lands.

The "technical assistance only" alternative would place the immediate burden of operational damage management work on other federal, state, or county agencies, private wildlife damage control agents and property owners. Individuals experiencing aquatic rodent damage would, independently or with NCWS recommendations, carry out and fund damage management activities. If this alternative were selected, NCWS could not direct how state or county agencies or property owners implement damage management. Some agencies or property owners may choose not to take action to resolve aquatic rodent damage problems while other situations may warrant the use of legally available management methods because of public demands.

3.4.5 Alternative 5. No NCWS Aquatic Rodent Damage Management in North Carolina

This alternative would result in no assistance from NCWS in reducing aquatic rodent damage in North Carolina. NCWS would not provide technical assistance or operational damage management services.

All requests for aquatic rodent damage management assistance would not be responded to by NCWS and would be referred to the NCWRC, private wildlife damage management agents, or private trappers. Assistance may or may not

be available from any of these entities. Lethal or nonlethal damage management still could be implemented by resource owners.

3.5 ALTERNATIVES CONSIDERED BUT NOT IN DETAIL, WITH RATIONALE

3.5.1 Eradication and Suppression

An eradication and suppression alternative would direct all NCWS aquatic rodent damage management efforts toward total elimination or suppression of these species.

Eradication of beaver or muskrat in North Carolina is not supported by NCWS or NCWRC. This alternative will not be considered by NCWS in detail because:

- NCWS and NCWRC oppose eradication of any native wildlife species.
- The eradication of a native species would be extremely difficult if not impossible to accomplish, and cost prohibitive.
- Eradication of native species is not acceptable to most members of the public.

Suppression would direct NCWS program efforts toward managed reduction of aquatic rodent populations. To consider large-scale population suppression as a goal of the NCWS program is not realistic, practical or allowable under present NCWS policy.

3.5.2 Population stabilization through birth control

Under this alternative, aquatic rodent populations would be managed by administering contraceptives to limit reproduction. Contraceptive measures for mammals can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immuno-contraception (the use of contraceptive vaccines). These techniques would require that aquatic rodents receive either single, multiple, or possibly daily treatment to successfully prevent conception. An aquatic rodent contraceptive, chemosterilant or immuno-contraceptive, if delivered to a sufficient number of individuals, could temporarily suppress local breeding populations via natural mortality combined with reduced fecundity. However, treated aquatic rodents would continue to cause damage, and aquatic rodents dispersing from untreated populations would be unaffected. Furthermore, at present, there are no chemical or biological contraceptive agents available or registered for aquatic rodents.

This alternative was not considered in detail because: (1) it would take a number of years of implementation before the aquatic rodent population would decline, and, therefore, damage would continue at the present unacceptable levels for a number of years; (2) surgical sterilization would have to be conducted by licensed veterinarians and would be extremely expensive; (3) it is difficult to effectively live trap or chemically capture the number of aquatic rodents that would need to be sterilized in order to effect an eventual decline in the population; and (4) no chemical or biological agents for contracepting aquatic rodents have been approved for use by state and federal regulatory authorities.

The use of contraceptives is not realistic, at this point, since there are no effective and legal methods of delivering contraceptives to aquatic rodents.

3.5.3 Compensation for Wildlife Damage Losses

The compensation alternative would direct NCWS program efforts and resources toward the verification of losses from aquatic rodents, and to providing monetary compensation for these losses. Analysis of this alternative in USDA (1997) shows that it has many drawbacks:

• Compensation would not be practical for public health and safety problems.

- It would require large expenditures of money to investigate and validate all losses, and to determine and administer appropriate compensation,
- Timely responses to all requests to assess and confirm losses would be difficult, and many losses could not be verified.
- Compensation would give little incentive to limit losses through other management strategies,
- Not all resource managers/owners would rely completely on a compensation program and unregulated lethal control would probably continue and escalate,
- Neither Congress nor North Carolina has appropriated funds for a compensation program.

3.5.4 Bounties

Refer to section 3.3.5

3.5.5 Relocation of Nuisance or Problem Aquatic Rodents

This alternative would direct NCWS to use relocation exclusively as a damage management technique.

Relocation of problem wildlife species is a technique that is sometimes used to alleviate wildlife damage problems. The success of a relocation effort, however, depends on the potential for the problem individuals to be captured efficiently and the existence of an appropriate relocation site (Nielsen 1988). Relocation may be appropriate in some situations when the species population is low, but aquatic rodents are abundant in much of the suitable habitat in North Carolina and relocation is not necessary for the maintenance of viable populations. Because beaver are abundant in North Carolina, beaver relocated into suitable habitat are very likely to encounter other beaver with established territories. Beaver are highly territorial and the newly introduced beaver, which are disoriented and at a disadvantage, are often viciously attacked and sometimes killed from these encounters (McNeely 1995). The survival of relocated animals is generally very poor due to the stress of relocation, so that in many cases an animal is released only to suffer mortality in a new environment (Craven 1992). Courcelles and Nault (1983) found that 50% (n=10) of radio-collared, relocated beaver died, probably from stress or predation resulting from the relocation.

Relocated beaver may also disperse long distances from the release site (Novak 1987a). Hibbard (1958) in North Dakota recorded an average dispersal distance by 17 relocated beaver to be about 9 miles and Denney (1952) in Colorado reported an average dispersal of 10.4 miles and a maximum dispersal of 30 miles for 26 relocated beaver. Beaver relocated on streams and later recaptured (n=200) moved an average distance of 4.6 miles, and in lake and pothole relocations (n=272) moved an average of 2 miles (Knudsen and Hale 1965). Only 12% of beaver relocated on streams and 33% of beaver relocated in the lake and pothole areas remained at the release site (Knudsen and Hale 1965).

The relocation of aquatic rodents that are causing damage could result in damage problems at the release site or dispersal site. In this case, the original damage problem has simply been shifted from one property to another. If NCWS relocated the problem animal, NCWS could possibly be held liable for any subsequent damage caused by that animal.

Live-trapping and relocating aquatic rodents is biologically unsound and not cost-efficient (Wade and Ramsey 1986). The AVMA, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose the relocation of mammals because of the risk of disease transmission, particularly for small mammals (Centers for Disease Control 1990). Among animal advocacy groups there appears to be disagreement about relocating wildlife to alleviate damage. The People for the Ethical Treatment of Animals opposes relocation of problem beaver because they believe relocation is cruel (Redmon 1999, 2000).

It is the policy of the NCWRC not to relocate beaver because of the unavailability of appropriate release sites,

biological and humaneness concerns related to poor survivorship of relocated animals, competition with established colonies, the potential for transmission of disease between populations, and the high probability that damage problems would be transferred from one site to another through relocation (C. Betsill, NCWRC, pers. comm.). NCWS did not consider this option in detail because of these same concerns.

3.5.6 Live-Capture and Kill Techniques Only

Live-capture and kill techniques may be used as part of the IWDM approach to reduce aquatic rodent damage. Snares, foothold traps, or other devices may be used to live-capture beaver. While these tools are effective and efficient for capturing aquatic rodents, the use of additional methods (e.g., conibear-type traps and shooting) would be necessary to reduce damage in a cost-effective manner.

3.5.7 Dam Removal or Water Control Structures Only

This alternative would direct NCWS to alleviate flooding damage by controlling the water levels without removing beaver. Dams would either be removed manually or with binary explosives. However, removing dams without removing the resident beaver is usually ineffective because beaver will quickly repair or replace the dam (McNeely 1995). Installing and maintaining water-level management devices or removing beaver dams on a daily or weekly basis may be cost prohibitive, and would not alleviate damage from gnawing or felling of trees.

Water-level management devices or pond levelers have been used for many years in many different states, with varying degrees of success. Various types of beaver pond levelers have been described (Arner 1964, Laramie and Knowles 1985, Lisle 1996, Roblee 1984) and installation of beaver pond levelers can be effective in reducing flooding in certain situations (Minn. Dept. Nat. Res. 1994, Miller and Yarrow 1994, Organ et al. 1996). However, a survey of Clemson Beaver Pond Levelers installed by WS in Mississippi revealed that only about 45% of levelers were successful (Nolte et al. 2000). Another study reported water-level management devices to be effective in only about 5% of flooding situations (Anonymous 1999). This is primarily because these structures were blocked by debris or siltation, and because the beaver often built a new dam nearby (McNeely 1995). If beaver are not removed, they may build dams upstream and downstream or block the device with mud and debris, rendering this method ineffective. Removal or reduction of the local beaver population, along with post-installation maintenance of the water-level management device itself, is usually required for this method to be effective (Nolte et al. 2000; E. Butler, USDA/APHIS/WS, pers. comm.).

Water-level management devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, pers. comm.), but may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). They may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device to handle, and debris is continuously carried to the site. Also, water-level management devices may not be effective during periods of unusually high rainfall or increased water flow because the device cannot handle the increased volume of water (Anonymous 1999, Wood et al. 1994).

The use of water-level management devices may require frequent maintenance, depending on the type of device used. Continued maintenance is necessary for the device to remain operational because stream flow, leaf fall, floods, and beaver activity will continuously bring debris to the water control device. This maintenance of water control devices can be expensive. The Maine WS program estimated annual maintenance costs at about \$350 per water-level management device, in addition to a cost of about \$250 - \$300 for construction and installation (E. Butler, USDA/APHIS/WS, pers. comm.). There may also be an annual costs to remove or reduce beaver populations to keep the devices operational (B. Sloan, USDA/APHIS/WS, pers. comm.). NCWS spent approximately \$1000 to \$1200 per device to install water-level management devices in North Carolina (NCWS unpubl. data).

The Beaver Deceiver is a water-level management device that attempts to prevent beaver from damming by

eliminating environmental cues that stimulate damming at culverts and by making culverts less favorable as dam sites. This is accomplished by quieting, calming, and deepening the water in front of culverts and constructing an odd shaped fence that both excludes beaver from a large area around the upstream opening of the culvert and confuses them so that they do not construct a dam against the fence. Preservation of wetland areas and fur resources for recreational trapping are benefits of using beaver deceivers (Lisle 1996, S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

NCWS would use water-level management devices as part of an integrated beaver management program at appropriate sites. However, the use of only water-level management devices would be insufficient to manage beaver damage throughout North Carolina. The Maine WS program installed over 160 water-level management devices in 1998. The primary benefits of using these devices in Maine are to maintain wetlands while minimizing flood damage and leaving beaver for fur trappers to harvest during the regulated trapping season each year (E. Butler, USDA/APHIS/WS, pers. comm.). In Mississippi, the WS program commonly installs water-level management devices at sites where the landowner intends to hunt ducks or lease duck hunting rights (B. Sloan, USDA/APHIS/WS, pers. comm.). Because there are few fur trappers in Mississippi, it is generally necessary to reduce beaver numbers annually at these sites to maintain the effectiveness of the devices (B. Sloan, USDA/APHIS/ WS, pers. comm.). Thus, in both Maine and Mississippi, the use of water-level management devices is supplemented by the removal of beaver from the site and an additional benefit is received which helps to justify the expense (i.e. reserving beaver for the fur harvest, providing duck hunting sites). Also, the construction, installation, and maintenance costs of water control devices in Maine and Mississippi are funded, in part, by sources such as state wildlife agencies, county governments, , or private organizations (E. Butler, USDA/APHIS/WS, pers. comm., B. Sloan, USDA/APHIS/WS, pers. comm.). Without such financial assistance and the existence of additional benefits, water-level management devices alone would generally be ineffective to reduce or prevent damage.

3.5.8 No Damage Management Until Damage Reaches a Certain Threshold

Some individuals may believe that NCWS should not conduct aquatic rodent damage management until economic losses become unacceptable or losses reach some predetermined "threshold" level. Although some losses can be expected and tolerated by most people and government entities, NCWS has the legal authority to respond to requests for wildlife damage management (Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c). People who request assistance from NCWS have decided that the WAC has been reached, while those who object frequently have no personal loss or liability from the presence of aquatic rodents NCWS uses the Decision Model (Slate et al. 1992) discussed in section 3.1.4 to determine appropriate strategies, and it is program policy to aid each requester to minimize losses. If damage management efforts are not initiated soon after a damage problem is detected, damages may escalate to excessive levels, or in the case of human health and safety, people may be injured or killed before the problem is resolved. Furthermore, if not given assistance, resource managers may resort to the use of illegal or unsafe methods (Walters 1996). In the Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for preliminary injunction. In part, the court found that a forest supervisor need only show that damage is probable to establish a need for wildlife damage management (U.S. District Court of Utah 1993).

3.5.9 Technical Assistance and Non-lethal Aquatic Rodent Damage Management with Lethal Management as a Last Resort

This alternative was not evaluated because it does not allow for a timely application of the full range of IWDM techniques to resolve wildlife damage problems and may compromise damage resolution in some cases (i.e., crop flooding, flooded roads, road beds, or human health and safety). In addition, considerations of wildlife needs, including T&E Species and Species of Special Concern, are not included in this alternative. If nonlethal damage

management efforts were not effective, damages may escalate to excessive levels, or in the case of human health and safety, people may be injured or killed before the problem is resolved. Furthermore, if not given appropriate assistance, resource managers may resort to the use of illegal or unsafe methods (Walters 1996). There are no standards to determine the diligence in applying non-lethal methods, nor are there standards to determine how many non-lethal methods or applications are necessary before the initiation of lethal damage management. Thus, only the presence or absence of non-lethal methods can be evaluated.

Conversely, under the preferred alternative (Alternative 1), technical assistance and operational non-lethal and lethal damage management are provided in the context of an IWDM approach to most efficiently and effectively resolve damage problems, and the WS Decision Model (Slate et al. 1992) is used to help determine the best approach for resolving wildlife damage. The current NCWS Program recognizes the importance of non-lethal methods as an important dimension of IWDM, and non-lethal methods are considered or used first in each damage management strategy, if applicable, as discussed above. These non-lethal methods are promoted through program directives, literature and in personal consultations with affected resource owners.

3.6 MITIGATION MEASURES AND STANDARD OPERATING PROCEDURES (SOPs) FOR AQUATIC RODENT DAMAGE MANAGEMENT

3.6.1 Mitigation and SOPs

Mitigation is any feature of an action that serves to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in North Carolina, uses many such mitigations and these are discussed in detail in Chapter 5 of USDA (1997). The following mitigations are incorporated into WS's SOPs and Alternatives 1, 2, 3 and 4:

Table 3. Mitigation Measures

MITIGATION MEASURES	ALTERNATIVES				
	1	2	3	4	5
Animal Welfare and Humaneness of Methods Used by WS					
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.	Х	х	Х	Х	
The Decision Model (Slate et al. 1992) would be used to identify effective biologically and ecologically sound aquatic rodent damage management strategies and their impacts.	Х	Х	Х	Х	
Captured non-target animals would be released unless it is determined by the NCWS personnel that the animal would not survive.	Х	Х	Х		
The use of traps and snares would conform to current laws and regulations administered by NCWRC and NCWS policy.	Х	Х	Х		

MITIGATION MEASURES			ALTERNATIVES				
	1	2	3	4	5		
Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used for live animals.	х	х					
The use of newly-developed, proven, non-lethal methods would be encouraged when appropriate.	X	x	х	Х			
Safety Concerns Regarding WS' Rodent Damage Management Methods							
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, would be used to determine aquatic rodent damage management strategies.	Х	х	Х				
Aquatic rodent damage management conducted on public lands would be coordinated with the management agency.	Х	х	Х				
NCWS employees that use explosives would be trained to use each material and would be certified to use explosives under an approved certification program.	х		х				
Live traps would be placed so that captured animals would not be readily visible from any road or public area.	Х	х	х				
Explosives use, storage, and disposal conforms to applicable laws and regulations.	х		х				
Material Safety Data Sheets for explosives would be provided to all NCWS personnel involved with specific damage management activities.	х		х				
Concerns about Impacts of Damage Management on T&E Species, Species of Special Concern, and Non-target Species.			e de la companya de l				
NCWS consulted with the USFWS regarding the nation-wide program and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.	Х	Х	Х				
NCWS take would be considered with the statewide "Total Harvest" (NCWS take and fur harvest) when estimating the impact on wildlife species.	Х	Х					
Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.	Х	Х	х				
NCWS personnel would be trained and experienced to select the most appropriate method for taking targeted animals and excluding non-target species.	х	х	Х				

MITIGATION MEASURES		ALTERNATIVES					
	1	2	3	4	5		
NCWS would initiate informal consultation with the USFWS following any incidental take of T&E Species.	х	х					

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter provides information regarding: 1) the analysis of environmental consequences, 2) the detailed analysis of each alternative against the issues considered, and 3) a summary of WS's impacts. This information is used to make informed decisions regarding the management of aquatic rodent damage in North Carolina.

4.1 ENVIRONMENTAL CONSEQUENCES

This section analyzes environmental consequences using Alternative 1 (the current program) as the baseline for comparing the other alternatives.

Soils, minerals, water quality/quantity, visual resources, and air quality within North Carolina would not be adversely impacted by any of the alternatives analyzed. These resources will not be analyzed further.

- 4.1.1 Social and Recreational Concerns are discussed in USDA (1997). They are also discussed throughout this document as they relate to the issues of concern.
- 4.1.2 Cumulative and Unavoidable Impacts are discussed in relationship to each wildlife species and environmental impacts are analyzed in this chapter. This EA recognizes that the total annual removal of individual animals from wildlife populations by all causes is the cumulative mortality. Analysis of the NCWS "takes" from 1993 to 2000, in combination with other mortality, indicates that cumulative impacts are not adversely affecting the viability of aquatic rodent populations or nontarget species. Research and consultation with the U.S. Fish and Wildlife Service (USFWS) indicate that the NCWS program will not result in any adverse cumulative impacts to T&E species (NCWS 1996; Letter from USFWS to NCWS October 1996; NCWS 1999; Letter from USFWS to NCWS September 1999, E-mail correspondence between USFWS and NCWS July 12 & 13, 2001.), and aquatic rodent damage management activities do not jeopardize public health and safety.
- **4.1.3** Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources. The NCWS program produces only negligible impacts on the supply of fossil fuels and electrical energy.

4.2 ISSUES ANALYZED IN DETAIL

This section presents the detailed analysis of each alternative against each of the issues considered.

4.2.1 Alternative 1. Fully Integrated Aquatic Rodent Damage Management (IWDM) for all Public and Private Land (No Action and Proposed Action)

Effects on aquatic rodent populations

IWDM involves the use of both nonlethal and lethal methods. The use of nonlethal methods, including habitat modification, water-level management devices, exclusion devices, and beaver dam removal, would be likely to have little or no effect on aquatic rodent populations, since aquatic rodents are usually not displaced by nonlethal methods, and if local populations are displaced by nonlethal methods, abundant quality habitat is usually available in

the surrounding area. Areas from which aquatic rodents are removed are frequently recolonized within one week to several years after the removal regardless of whether or not nonlethal methods are applied. The amount of time until an area is recolonized depends on the habitat type, time of year, population density in the surrounding area, and other factors. The effects of lethal methods on aquatic rodents are discussed in the following sections.

Beaver Population Impact Analysis

The NCWRC compiles information on population trends and harvests and uses this information to manage aquatic rodent populations in North Carolina. NCWS used NCWRC data, NCWS data, and available literature to generate population estimates and analyze the effects of damage management on beaver in North Carolina.

Beaver generally occur in family groups or colonies that are typically comprised of an adult pair with two to four offspring from the previous breeding season, two or three yearlings, and sometimes one or more other beaver. However, litter size can range from one to nine. Colony size appears to be a function of habitat quality (Hill 1982). Average colony size has been documented as ranging from 3.0 to 9.2 beaver per colony (Novak 1987a). Average colony sizes of 4.6, 5.3, 5.3, and 5.5 have been reported for Alabama, Georgia, West Virginia, and South Carolina, respectively. An overall average colony size for the United States of 5.2 has been reported (Hill, 1982, Novak 1987a). NCWS data from 1993 to 1999 is in agreement with these figures and indicates that average beaver colony size in North Carolina may be 5.2 beaver per colony (range of annual averages = 4.5 to 6.1) (NCWS unpublished data).

Beaver population density is reported in terms of colonies per length of stream, especially in areas with well defined streams, or per unit of area (ie., habitat), especially in relatively flat swampy areas (Hill 1982). Novak (1987a) summarized reported beaver colony abundance as ranging from 0.5 - 2.4 colonies per mile of stream and from 0.24 to 6.3 colonies per square mile of habitat (Novak 1987a). In Alabama, beaver may have a maximum density of as high as 3.1 colonies per mile of stream (Hill 1982). Assuming an average colony size of 5.2 beaver per colony, NCWS data from 1993 to 1999 indicates that beaver densities in areas of North Carolina where NCWS has conducted beaver damage management average 9.7 colonies per square mile (range of annual averages = 3.1 to 14.6 colonies per square mile).

The professional opinions of wildlife biologists at NCWRC (P. Sumner, NCWRC, pers. comm.) and NCWS suggest that beaver population levels in North Carolina are within the range found by Novak (1987a). To be conservative, this analysis assumes actual densities in North Carolina to be at the lowest end of the range given by Novak (1987a) (ie., an average of 3 beavers per family and 0.5 families per mile of stream). North Carolina has an estimated minimum of 40,000 miles of streams (A. Renn, DENR, Div. Water Qual., pers. comm.). This includes only the larger streams that have been classified. The actual number of miles, including smaller streams, may be three to four time this figure (J. Southerland, DENR, Div. Water Res., pers. comm., Jeff Bruton, DENR, Div. Water Res., pers. comm.). Under the above reasonable and conservative analysis, a minimum estimate of the beaver population in North Carolina is 60,000. Using the more reasonable estimate of 5.2 beaver per colony, a more reasonable estimate of 120,000 miles of stream (ie., three times the miles of classified streams), an average estimate for beaver colonies per mile of stream of 1.5 colonies per mile, and allowing for the lower population density in the western part of the state, the estimated population is 468,000 beaver (120,000 miles of stream X 1.5 colonies per mile X 5.2 beaver per colony X 1/2 the state). There are about 7,812 square miles of wetlands in North Carolina (J. Dorney, Div. Water Qual., pers. comm. Using the estimate of 50.4 beaver per square mile (9.7 colonies of 5.2 beaver each) in areas where NCWS has conducted beaver damage management, a similar population estimate of 394,000 beaver can be calculated.

NCWS took 1,162, 1,732, 3,137, 4,684, 4,624, 4,475, 4,490, and 5236 beavers in FY1993, 94, 95, 96, 97, 98, 99, and 2000, respectively. Private harvest of beaver as reported by the NCWRC (estimated by the number of pelts reported sold) during the 1993, 94, 95, 96, 97, 98, and 99 harvest seasons was 427, 913, 1,915, 1,396, 1,935, 1,975,

and 1,653 beaver, respectively. Additionally, NCWRC estimated that, during FY1995, 1996, 1997, 1998, and 1999, 99, 93, 140, 45, and 51 beaver, respectively, were taken by WDCA to alleviate damage or threats to human health and safety (P. Sumner, NCWRC, pers. comm.). Data for private fur harvest and WDCA take for FY2000 was not available at the time this document was prepared. The ADC Final Environmental Impact Statement (FEIS) (USDA 1997) determined that beaver populations can withstand an annual harvest rate of up to 30% without declining. The cumulative take of beavers during FY1999, including take from the regulated harvest season, NCWS damage management activities, and WDCA activities, was 6,266. This is 10% of the minimum population and 1,3% of the more probable population estimate based on stream miles, or 1.6% of the more probable population estimate based on wetland acres. Thus, cumulative take appears to be far beneath the level that would begin to cause a decline in the population. Even if the harvest levels were increased by 200%, the impact to the beaver population would be at an acceptable level. The cumulative impact of harvest on the beaver population over the past five years is therefore considered to be of extremely low magnitude. Since harvest levels have been relatively uniform over the past five years, it is believed that harvest levels will remain similar in the future and that cumulative impacts of harvest will continue to be minimal. NCWRC biologists have concurred with this conclusion (P. Sumner, NCWRC, pers. comm. 1999). The NCWRC has determined that there is no evidence to suggest that human mediated mortality resulting from regulated fur harvests and damage management, including the proposed action, will be detrimental to the survival of beaver populations in North Carolina (P. Sumner, NCWRC, pers. comm.).

Beaver fecundity is dependent on food availability, population density, and other factors (Novak 1987a). Density dependent fecundity means that reproductive rates generally increase as a population is reduced and decrease as a population increases toward carrying capacity. This is a natural function of many wildlife populations that helps to naturally mitigate population reductions. Wildlife populations that are below carrying capacity can sustain higher levels of harvest due to compensatory mechanisms that allow for higher reproductive rates (Logan et al. 1996).

Some individuals may be concerned that removing beaver would not resolve damage problems because beaver fecundity is density dependent and dispersing beaver would recolonize the site. NCWS' objective is not to manage aquatic rodent populations in North Carolina, but rather to address requests for assistance to reduce damage at specific sites. While the removal of aquatic rodents may cause an increase in reproduction in a localized area, and while dispersing aquatic rodents may recolonize management areas, NCWS believes that with periodic maintenance these factors will not hinder effective damage management. Furthermore, while beaver fecundity may be density dependent and lower densities may cause an increase in litter size (Novak 1987a), density and dispersal are also reported as a function of many other factors such as habitat (water quality, drought conditions, and food), mortality (trapping, predation, and disease), and behavior (territorial activities and intrafamily aggression) (Aleksiuk 1970 as cited in Novak 1987a, Tyurnin 1983 as cited in Novak 1987a, Novak 1987a). Other factors were also identified as possibly influencing fecundity. The dominant female in a family breeds each year whether it is in good or poor habitat and whether it is in a trapped or static population (Novak 1977 as cited in Novak 1987a, Wigley et al. 1983 as cited in Novak 1987a), and litter size can vary from such factors as food availability and quality (Longley and Moyle 1963 as cited in Novak 1987a, Huey 1956 as cited in Novak 1987a, Gunson 1967 as cited in Novak 1987a), elevation (Rutherford 1964 as cited in Novak 1987a, Harper 1968 as cited in Novak 1987a), weight of the female (Wigley et al. 1983 as cited in Novak 1987a, Pearson 1960 as cited in Novak 1987a, Novakowski 1965 as cited in Novak 1987a, Henry and Bookout 1969, Gunson 1970 as cited in Novak 1987a, Boyce 1974 as cited in Novak 1987a), and age of the female (Henry and Bookout 1969, Lyons 1979, Payne 1989, Gunson 1967 as cited in Novak 1987a, Morris 1976 as cited in Novak 1987a).

Muskrat Population Impact Analysis

Muskrats are considered abundant in North Carolina, and they occupy suitable habitat throughout the State (P. Sumner, NCWRC, pers. comm.). NCWS took only 42, 24, 53, 147, 97, 35, 52, and 97 muskrats for depredation purposes during FY93, 94, 95, 96, 97, 98, 99, 00 respectively. Private harvests, estimated by the number of pelts reported sold, during the 93, 94, 95, 96, 97, 98, and 99 regulated harvest seasons were 4,691, 7,130, 4,616, 2,195,

6,002, 4,485, and 1,439 muskrats, respectively. Additionally, NCWRC estimated that, during FY1995, 1996, 1997, 1998, and 1999, 29, 142, 132, 214, and 142 muskrats, respectively, were taken by WDCA to alleviate damage or threats to human health and safety (P. Sumner, NCWRC, pers. comm.). Data for private fur harvest and WDCA take for FY2000 was not available at the time this document was prepared.

Muskrats are highly prolific and produce two to six litters per year with an average of three to nine young per litter, a characteristic that make them relatively immune to over harvest. Harvest rates of three to eight per acre are reported to be sustainable in muskrat populations (Boutin and Birkenholz 1987). There are an estimated 4.8 million acres of freshwater wetlands in North Carolina (J. Dorney, Div Water Quality, pers. comm.). Assuming, very conservatively, that muskrats occupy only 1% of the freshwater wetlands in North Carolina, harvests totaling more than 144,000 per year (4.8 million acres X 1% X 3 muskrats harvested per acre) could be sustainable. Clearly, mortality as a result of fur harvest or damage management has a negligible impact on the muskrat population in North Carolina. NCWRC concurs with this conclusion and has determined that there is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management, including the proposed action, will be detrimental to the survival of muskrat populations in North Carolina (P. Sumner, NCWRC, pers. comm). It is believed that future harvests will remain similar to these documented over the past five years.

Nutria Population Impact Analysis

Nutria are considered abundant in North Carolina, and they occupy suitable habitat along the coast and several miles inland (P. Sumner, NCWRC, pers. comm.). NCWS took only 0, 0, 34, 139, 271, 169, 284, and 134 nutria for depredation purposes during FY93, 94, 95, 96, 97, 98, 99, and 00 respectively. Private harvests, estimated by the number of pelts reported sold, during the 93, 94, 95, 96, 97, 98, and 99 regulated harvest seasons were 271, 445, 153, 13, 126, 202, and 14 nutria, respectively. Additionally, NCWRC estimated that, during FY1997 and 1999, only 1 and 4 nutria, respectively, were taken by WDCA to alleviate damage or threats to human health and safety (P. Sumner, NCWRC, pers. comm.). Data for private fur harvested and WDCA take for FY2000 was not available at the time this document was prepared.

Nutria are highly prolific. They breed year-round and produce multiple litters annually with an average of 4.5 to 5 young per litter, depending on time of year, age of female, and habitat quality. Kinler et al. (1987) reported nutria density estimates from different studies ranging from 0.5 to 138 per hectare (0.2 to 56 per acre). Using the lowest estimate of population density, assuming that the range of nutria in North Carolina encompasses only 1/10 of the 4.8 million acres of freshwater wetlands and ½ of the 0.2 million acres of other wetlands, and assuming that nutria only occupy 1% of the wetlands in their range, a conservative estimate of the nutria population in North Carolina is 116,000 nutria. Clearly, mortality as a result of fur harvest or damage management has a negligible impact on the nutria population in North Carolina. NCWRC concurs with this conclusion and has determined that there is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management, including the proposed action, will be detrimental to the survival of nutria populations in North Carolina (P. Sumner, NCWRC, pers. comm). It is believed that future harvests will remain similar to these documented over the past five years.

While, the above population analyses demonstrate that the proposed action is not likely to adversely affect aquatic rodent populations in North Carolina either regionally or statewide, NCWS recognizes that local populations (e.g. the aquatic rodents living in a particular farm pond, or the aquatic rodents occupying a short stretch of stream on a particular property) may be adversely affected. Some people may find this unacceptable. However, due to the nature of the action (i.e., to manage aquatic rodent damage in particular localized areas), the presence of healthy aquatic rodent populations in surrounding or nearby areas, and the absence of an adverse effect on regional or statewide population, NCWS believes the loss of a minimal number of animals comprising a localized population is acceptable.

In localized areas where aquatic rodent densities are excessive, damage management which results in the removal of a number of aquatic rodents from the population may result in less competition for resources among the remaining animals. A decrease in competition among aquatic rodents may result in better habitat quality and a healthier overall population within the localized area, as well as a decrease in aquatic rodent damage.

Removing problem animals periodically is generally more ecologically sound than altering the riparian or wetland habitats to lower carrying capacity. Most people prefer periodic management as maintenance of a domain, e.g., they would rather mow a lawn weekly than to remove the turf and substitute it with rocks, gravel or other lower maintenance materials.

Effects on wetland habitats, plants and other wildlife species, including T&E species

Non-target wildlife species, including river otters, raccoons, ducks, Canada geese, turtles, American alligators, and cottonmouths, may occasionally be taken in traps or snares used for aquatic rodent damage management. However, NCWS employees receive extensive training to avoid catching non-target animals and use expertise in trap modification, adjustment, and placement, the use of appropriate trap types and sizes, and lure type and placement to minimize non-target takes.

NCWS employees have the backing of a nationwide group of research and development scientists whose sole mission is to develop improved methods for dealing with wildlife damage problems. NCWS often participates in research projects to improve the selectivity and humaneness of traps while striving to bring new findings and products into practical use. NCWS is currently working with state fur bearer biologists in New York and North Carolina to test different trap trigger configurations to reduce non-target catches.

Many of the nontarget animals captured by NCWS during aquatic rodent damage management, including all American alligators and over half of all turtles, are released unharmed. For each of the species listed above, not including ducks, raccoon, river otter, and turtles, the total number of animals killed for the seven year period of 1993 to 1999 was less than four. For turtles, ducks, raccoons, and river otters it was only 434 (an average of 62 per year), 11 (an average of 1.6 per year), 117 (an average of 17 per year) and 321 (an average of 46 per year), respectively. The species and numbers of nontarget animals captured by NCWS from 1993 to 2000 are shown in Table 2.

Considering the number of nontarget animals taken by NCWS during aquatic rodent damage management activities, it is not likely that these activities would have any adverse effect on populations of nontarget species. NCWRC concurs with this conclusion (P. Sumner, NCWRC, pers. com.). Nevertheless, since river otter are a high profile species, a river otter population impact analysis is provided below.

River otter population densities in linear waterways have been reported as ranging from 1 otter per 6.3 miles to 1 otter per 12.9 miles of waterway (Melquist and Dronkert 1987). However, it is likely that river otter populations in the Southeast, including North Carolina, are much higher than in the areas from which these estimates were reported. Using the minimum estimate of 40,000 miles of stream in North Carolina and the lowest population density of 1 otter per 12.9 miles of stream, the estimated North Carolina river otter population would be 3,100. Using the more reasonable estimate of 120,000 miles of stream and the more likely higher population density of at least 1 otter per 6.3 miles of stream the river otter population would be 19,048. The average number of otter removed by NCWS annually is 41, or 1.3% of the lowest population estimate and 0.2% of the more likely population estimate. It is not likely that an addition of 1.3% or less to the harvest of river otter by fur trappers would adversely affect river otter populations in North Carolina. NCWRC concurs with this conclusion (P. Sumner, NCWRC, pers. com.).

The use of firearms to manage aquatic rodent damage is safe and extremely selective. Shooting will have no effect on wetland habitats, plants or other wildlife species.

The use of nonlethal methods are not likely to have any negative affect on wetland habitats, plants, or other wildlife species, including T&E species. Exclusion devices, such as fencing, are generally used only on a relatively small scale on residential or commercial properties in urban or rural settings to protect specific plants from aquatic rodent damage, and are not likely to have any adverse effect on wetland habitats, plants, or other species. Similarly, habitat modification would likely only be recommended on a small scale to protect resources on residential or commercial property in urban or rural settings. Dam removal or the installation of water-level management devices is conducted because beaver have flooded areas such as yards, parks, roads, railroads, timberlands, croplands, pastures, and other types of property or resources that were not previously flooded or wetlands. Dam removal or the installation of water-level management devices simply returns a site to its previous status and is not likely to have any adverse effects on T&E or other non-target species. Beaver dams are removed manually or with explosives in according to Section 404 of the Clean Water Act (see Appendix C) for the purpose of returning streams, channels, dikes, culverts, and irrigation canals to their original condition.

NCWS knowledge and expertise, a review of the literature, and consultation with the USFWS indicate that the current NCWS integrated aquatic rodent damage management program is not likely to result in any adverse cumulative impacts to T&E species (NCWS 1996; Letter from USFWS to NCWS October 1996; NCWS 1999; Letter from USFWS to NCWS July 2001, E-mail correspondence between USFWS and NCWS July 12 & 13, 2001.). NCWS also believes that the current NCWS integrated aquatic rodent damage management program is not likely to result in any adverse cumulative impacts to state listed species.

Aquatic rodents can cause damage to bottomland, wetland or other habitats and plants, and this can be detrimental to other wildlife species. Refer to sections 1.2.2 and 1.2.3 for details. In these situations, the removal of aquatic rodents can be beneficial to plant and wildlife species that depend on the habitat types restored by aquatic rodent damage management. It is likely that WS's aquatic rodent damage management program may be beneficial for the protection of isolated or critical populations of T&E species (J. Johnson, NCWRC, pers. comm., M. Cantrell, USFWS, pers. comm.).

Effects on human and pet health and safety

Lethal methods used by NCWS, including shooting, trapping and snaring, are likely to pose only a minimal or no threat to public and pet health and safety. The use of firearms to manage aquatic rodent damage is a safe and extremely specialized technique that is not likely to poses any threat to public and pet health and safety. To ensure safe use, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees are also required to certify that they meet the criteria of the *Lautenberg Amendment* which prohibits firearms possession by anyone who has been convicted of a misdemeanor crime of domestic violence. WS employees adhere to standard firearm safety precautions and comply with all laws and regulations governing the lawful use of firearms.

NCWS uses expertise in trap modification, adjustment, and placement, the use of appropriate trap types and sizes, and lure type and placement to minimize exposure or threats to the health and safety of the public and pets. Conibear-type traps are restricted to use in water sets, which further reduces threats to public and pet health and safety. On rare occasions, when dogs are captured in foothold traps or snares, they are released with little or no injury. During the seven year period from 1993 - 99, only four dogs were captured in NCWS traps set for aquatic rodent damage management. All of these animals were released unharmed. No other pets and no humans have been captured or injured by NCWS traps or snares. The careful, regulated use of traps and snares by NCWS professionals poses only a very minimal threat to public and pet health and safety.

The use of nonlethal methods are not likely to have any adverse effect on public and pet health and safety. WS uses binary explosives to remove beaver dams. However, WS' explosives use is carefully regulated and monitored to

insure safety to WS employees and the public. WS personnel who use explosives undergo extensive training and are certified to safely use explosives. They adhere to the safe storage, transportation and use policies and regulations of WS, the Bureau of Alcohol, Tobacco and Firearms, the Occupational Safety and Health Administration, and the Department of Transportation. Binary explosives require two components to be mixed before they can be actuated which virtually eliminates the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not authorized by WS. No adverse effects to public safety or pets are expected from the use of explosives by NCWS.

Aquatic rodents activities can threaten human and pet health and safety. Refer to sections 1.2.2 and 1.2.3 for details. In these situations, the removal of aquatic rodents can be beneficial to the safety and health of humans and pets. It is likely that WS's aquatic rodent damage management program will be beneficial for the protection of human and pet health and safety. NCWS would rely on the expertise of public health officials to determine the source of disease outbreaks. NCWS would not conduct any beaver damage management to protect against giardiasis or other diseases unless assistance was requested by a public health department that had determined that beaver presence posed a public health risk.

Impacts to stakeholders, including aesthetics

This alternative would have only a minimal negative impact on stakeholders interested in direct benefits derived from consumptive or nonconsumptive use of aquatic rodents or those interested in indirect benefits of aquatic rodents, since thriving populations of aquatic rodents exist throughout extensive portions of North Carolina and current programs are not interested in or capable of altering this situation. NCWS' aquatic rodent damage management activities are aimed only at managing damage in localized situations at the request of landowners or managers for the purpose of protecting the landowner's property, livelihood, or health and safety or for the protection of the health and safety of the general public. As discussed previously, IWDM seeks to preserve and enhance the beneficial aspects of the wildlife species involved, other wildlife species and the environment. Opportunities to derive consumptive or nonconsumptive benefits from aquatic rodents at a particular site could be limited or eliminated by aquatic rodent damage management. However, these opportunities will continue to be available at numerous other sites throughout the state.

Stakeholders interested in the direct benefits derived from consumptive or nonconsumptive use of wildlife or those interested in indirect benefits of wildlife would be positively impacted by this alternative. The removal of aquatic rodents and the restoration of alternate habitat types will provide an abundance of opportunities for interested stakeholders to derive direct and indirect benefits from alternate habitat types and other plant and wildlife species. This alternative is likely to preserve diversity of and increase opportunities for direct and indirect benefits derived from wildlife and the environment since both beaver-created habitats and alternate habitats with their associated species will be available in abundance for the enjoyment of interested stakeholders.

Stakeholders experiencing aquatic rodent damage, threats to their livelihood, or threats to health and safety will be positively impacted by this alternative, since they will have access to expertise in aquatic rodent damage management and professional quality damage management services. An IWDM approach will allow for the use of the most appropriate damage management methods and strategies in each specific situation.

Humaneness

Pain, suffering, stress and death are natural occurrences commonly and routinely experienced in the lives of wild animals as a result of interactions with other animals, humans and the environment. No human activity and no aquatic rodent damage management alternative can eliminate these phenomena from the lives of aquatic rodents. Under this alternative, aquatic rodents would continue to experience pain, suffering, stress and death. However, damage management may reduce local populations of beaver favoring habitat suitability and the health of the overall

population and consequently reduce pain, suffering, stress and death for individual animals that are not causing damage.

This alternative would allow resource managers to select the best strategy for managing damage in each particular situation. This would include selecting the use of nonlethal methods when appropriate. This alternative would consider the needs, desires, and feelings of humans experiencing aquatic rodent damage and would allow for the selection of management strategies which would best address humane issues related to both humans and animals. In situations where it would be necessary to use lethal methods, NCWS would select methods to minimize pain, suffering, stress. Nevertheless, some animals would experience pain, suffering, stress and death. This pain, suffering, stress and death must be weighed against the positive effects the action would have on humans who are being adversely affected by the activities of aquatic rodents in the particular situation.

Under this alternative, resource owners or managers would have access to expertise in aquatic rodent damage management and professional quality damage management services, and they would be less likely to resort to the use of illegal or unauthorized methods that may cause more pain, suffering, stress, and/or death than methods used by experienced NCWS personnel.

4.2.2 Alternative 2. Only Lethal Aquatic Rodent Damage Management

The primary difference between this alternative and Alternative 1 is that this alternative may not allow resource managers to select the best strategy for managing damage in each particular situation. In particular, resource managers would not being able to select the use of nonlethal methods when appropriate.

Effects on aquatic rodent populations

The number of aquatic rodents removed annually under this alternative would not be likely to differ substantially from the number removed under the proposed action. NCWS would continue to apply or recommend lethal methods in a responsible manner and only when applicable and best suited to the situation. In other situations, NCWS would not be able to help resource owners or managers or would refer them to other agencies. Since the number of aquatic rodents removed would be similar, the population impact analyses under section 4.2.1 would apply under this alternative.

Effects on wetland habitats, plants, and other wildlife species

The number of nontarget species taken under this alternative would not be likely to differ from the number taken under Alternative 1. The effects of this alternative would be similar to those under Alternative 1 with the following exceptions. Since dam removal would not be allowed it would be more likely that aquatic rodents would adversely affect habitats which are important to aquatic plants or other wildlife species. Also, stakeholders who would not be able to obtain relief from flooding may develop a greater dislike and a lower tolerance level for aquatic rodents. This may lead to these stakeholders seeking undesirable or unapproved methods to alleviate flooding. These methods could have a greater adverse affect on the environment than conventional aquatic rodent damage management methods.

Effects on human and pet health and safety

The effects of this alternative on human and pet health and safety would be the same as discussed for lethal methods under Section 4.2.1. However, because NCWS would not be able to remove beaver dams, there would be a greater threat to human health and safety in situations where flooding threatened human health and safety. In these situations, removal of aquatic rodents alone would generally not be sufficient to reduce or eliminated threats to human health and safety.

Impacts to stakeholders, including aesthetics

This would be similar to that discussed under Section 4.2.1, except that this alternate would not allow for the preservation of non-beaver-created wetland, aquatic, and bottomland habitats and their associated species. Also, in many situations, it would be difficult for stakeholders experiencing aquatic rodent damage to benefit from NCWS aquatic rodent damage management activities since beaver dams would not be removed by NCWS. Some stakeholders would remove dams on their own, but NCWS would not be able to give advice or assistance related to dam removal.

Humaneness

This would differ from that discussed under Section 4.2.1, since this alternate may not allow resource managers to select the best alternative for managing damage in each particular situation. This would include not being able to select the use of nonlethal methods when appropriate. This alternative would not consider the needs, desires, and feelings of humans experiencing flooding due to aquatic rodent activity and would not allow for the selection of management strategies which would best address humane issues related to both humans and animals. Only the killing of aquatic rodents would be allowed.

4.2.3 Alternative 3. Only Non-lethal Aquatic Rodent Damage Management

The primary difference between this alternative and Alternative 1 is that this alternative may not allow resource managers to select the best alternative for managing damage in each particular situation. In particular, resource managers would not being able to select the use of lethal methods when appropriate.

NCWS would continue to apply or recommend nonlethal methods in a responsible manner and only when applicable and best suited to the situation. In other situations, NCWS would not be able to help resource owners or managers or would refer them to other agencies. Since NCWS would not remove aquatic rodents under this alternative, it may be more difficult, time consuming and expensive to apply nonlethal methods in any particular location.

Effects on aquatic rodent populations

The use of nonlethal methods, including habitat modification, water-level management devices, exclusion devices, and beaver dam removal, would be likely to have little or no effect on aquatic rodent populations, since aquatic rodents are usually not displaced by nonlethal methods, and if local populations are displaced by nonlethal method, abundant quality habitat is usually available in the surrounding area.

Aquatic rodent populations would be likely to continue to increase throughout the state due to inadequate levels of hunting, trapping or damage management. Some local populations of aquatic rodents may remain stable or decline due to local hunting, trapping or damage management. Excessive population densities of aquatic rodents may result in competition and habitat degradation. This, in turn, may result in a decrease in overall population health.

Some resource owners experiencing damage may trap or shoot aquatic rodents or hire private WDCA's or trappers. Other resource owners experiencing damage may, out of frustration, use poisons or other illegal or unsafe methods to control local populations of aquatic rodents (Walters 1996). The use of illegal or unsafe methods, especially poisons, may have a greater detrimental impact on local aquatic rodent populations than professional damage management.

Effects on wetland habitats, plants and other wildlife species, including T&E species

The use of nonlethal methods is not likely to have any negative effect on wetland habitats, plants, or other wildlife

species, including T&E species. Exclusion devices are generally used only on a relatively small scale on residential or commercial properties in urban or rural settings to protect specific plants from aquatic rodent damage, and are not likely to have any adverse effect on wetland habitats, plants, or other species. Similarly, habitat modification would only be recommended on a small scale to protect resources on residential or commercial property in urban or rural settings. Dam removal or the installation of water-level management devices is conducted because beaver have flooded areas such as yards, parks, roads, railroads, timberlands, croplands, pastures, and other types of property or resources that were not previously flooded or wetlands. Dam removal or the installation of water-level management devices simply returns a site to its previous status and is not likely to have any adverse effects on T&E or other non-target species. Beaver dams are removed manually or with explosives in according to Section 404 of the Clean Water Act (see Appendix C) for the purpose of returning streams, channels, dikes, culverts, and irrigation canals to their original condition.

As aquatic rodent populations continue to increase throughout the state, damage to timber and other agricultural lands or crops, ornamentals plants, native vegetation, wildlife habitat and the species dependent on that habitat, and other natural resources would also continue to increase. Refer to Sections 1.2.2 and 1.2.3 for details regarding beaver damage to wetlands, plants and other wildlife species.

Due to the severity of aquatic rodent damage in North Carolina, management would probably continue under the direction of other agencies or the private sector. NCWS makes great effort to minimize or eliminate potential harmful effects of aquatic rodent damage management to natural resources by educating the public regarding the values of wetlands and wildlife, researching and implementing methods to avoid capturing or harming nontarget species, and consulting with USFWS regarding T&E species. Private WDCA's and trappers may not take as thorough of precautions to protect the environment and avoid nontarget species. Some resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping and shooting techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Therefore, in the absence of the professional services of NCWS, negative effects on wetlands, plants and other wildlife may be more likely to occur.

Effects on human and pet health and safety

The use of nonlethal methods is not likely to have any adverse effect on public and pet health and safety. WS uses binary explosives to remove beaver dams. However, WS explosives use is carefully regulated and monitored to insure safety to WS employees and the public. WS personnel who use explosives undergo extensive training and are certified to safely use explosives. They adhere to the safe storage, transportation and use policies and regulations of WS, the Bureau of Alcohol, Tobacco and Firearms, the Occupational Safety and Health Administration, and the Department of Transportation. Binary explosives require two components to be mixed before they can be actuated which virtually eliminates the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not authorized by WS. No adverse effects to public safety or pets are expected from the use of explosives by WS.

Unregulated increases in beaver, muskrat and nutria populations are likely to threaten public and pet health and safety when nonlethal methods are ineffective. Refer to Sections 1.2.2 for details. Additionally, resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping, shooting and explosives techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Improper use of management techniques or use of illegal or unsafe techniques may cause increased risks to public and pet safety compared to the professional use of safe and effective management techniques.

Impacts to stakeholders, including aesthetics

This alternative would not be likely to have any adverse impact on stakeholders interested in direct benefits derived from consumptive or nonconsumptive use of aquatic rodents or those interested in indirect benefits of aquatic

rodents, since thriving populations of aquatic rodents already exist throughout extensive portions of North Carolina and under this alternative these thriving populations would continue to exist if non-WS personnel did not take lethal actions.

Stakeholders experiencing aquatic rodent damage would be negatively impacted by this alternative when nonlethal methods were ineffective, since the occurrences and magnitude of damage would increase and many stakeholders would not have personal expertise in damage management or access to professional quality damage management services.

Humaneness

This would differ from that discussed under Section 4.2.1, since this alternate may not allow resource managers to select the best strategy for managing damage in each particular situation. This would include not being able to select the use of lethal methods when appropriate. This alternative would not consider the needs, desires, and feelings of humans experiencing damage due to aquatic rodent activity and would not allow for the selection of management strategies which would best address humane issues related to both humans and animals. Those individuals who are opposed to lethal damage management may prefer this alternative.

Under this alternative, resource owners or managers could continue to use lethal and non-lethal methods to reduce aquatic rodent damage. In addition, some resource/property owners may use illegal methods to control local populations of aquatic rodents out of frustration with continued damage. Some of these illegal actions may cause more pain, suffering, stress, and/or death than methods used by experienced WS personnel.

4.2.4 Alternative 4. Only Technical Assistance

The primary difference between this alternative and Alternatives 1-3, is that NCWS would have no direct effect on aquatic rodent populations. NCWS would only be able to give advice. Resource owners or managers or their agents would have the option of following NCWS advice or taking a different approach to damage management.

Effects on aquatic rodent populations

Since NCWS would have no direct effect on aquatic rodent populations, aquatic rodent populations would be likely to continue to increase throughout the state due to inadequate levels of hunting, trapping or damage management. Some local populations of aquatic rodents may remain stable or decline due to local hunting, trapping or damage management. Excessive population densities of aquatic rodents may result in competition and habitat degradation. This, in turn, may result in a decrease in overall population health.

Some resource owners experiencing damage may trap or shoot aquatic rodents or hire private WDCA's or trappers. Other resource owners experiencing damage may, out of frustration, use poisons or other illegal or unsafe methods to control local populations of aquatic rodents (Walters 1996). The use of illegal or unsafe methods, especially poisons, may have a greater detrimental impact on local aquatic rodent populations than professional damage management methods available under Alternative 1. Stakeholders would have access to professional expertise in aquatic rodent damage management. This access to aquatic rodent damage management expertise may help to limit the use of inappropriate, illegal, or unsafe methods. Therefore, this alternative is preferable to Alternative 5, No Management, but less preferable than Alternative 1, IWDM.

Effects on wetland habitats, plants and other wildlife species, including T&E species

Under this alternative, NCWS would have no direct effect on wetland habitats, plants and other wildlife species. However, due to the severity of aquatic rodent damage in North Carolina, direct management may continue under the direction of other agencies or the private sector. NCWS makes great effort to minimize or eliminate potential harmful effects of aquatic rodent management to natural resources by educating the public regarding the values of wetlands and wildlife, researching and implementing methods to avoid capturing or harming nontarget species, and consulting with USFWS regarding T&E species. Private WDCA's and trappers may not take as thorough of precautions to protect the environment and avoid nontarget species. Some resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping and shooting techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Stakeholders would have access to professional expertise in aquatic rodent damage management. This access to aquatic rodent damage management expertise may help to limit the use of inappropriate, illegal, or unsafe methods which may allow for less negative effects on wetland habitats, plants and nontarget animals. Therefore, this alternative is preferable to Alternative 5, No Management, but less preferable than Alternative 1, IWDM.

As aquatic rodent populations continue to increase throughout the state, damage to timber and other agricultural lands or crops, ornamentals plants, native vegetation, wildlife habitat and the species dependant on that habitat, and other natural resources would also continue to increase. Refer to Sections 1.2.2 and 1.2.3 for details regarding beaver damage to wetlands, plants and other wildlife species.

Effects on human and pet health and safety

Under this alternative, NCWS would have no direct effect on human and pet health and safety. In the absence of an organized state-wide aquatic rodent damage management program, unregulated increases in aquatic rodent populations are likely to threaten human and pet health and safety. Refer to Sections 1.2.2 for details. Additionally, resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping, shooting, and explosives techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Improper use of management techniques or use of illegal or unsafe techniques may cause increased risks to public and pet safety compared to the professional use of safe and effective management techniques available under Alternative 1. Stakeholders would have access to professional expertise in aquatic rodent damage management. This access to aquatic rodent damage management expertise may help to limit the use of inappropriate, illegal, or unsafe methods which may allow for a lower risk to public and pet health and safety. Therefore, this alternative is preferable to Alternative 5, No Management, but less preferable than Alternative 1, IWDM.

Impact to stakeholders, including aesthetics

This alternative would not be likely to have any adverse impact on stakeholders interested in direct benefits derived from consumptive or nonconsumptive use of aquatic rodents or those interested in indirect benefits of aquatic rodents, since thriving populations of aquatic rodents already exist throughout extensive portions of North Carolina and under this alternative these thriving populations would continue to exist if action was not taken by non-WS personnel.

Stakeholders experiencing aquatic rodent damage would be negatively impacted by this alternative, since the occurrences and magnitude of damage would be likely to increase if no action is taken. Stakeholders would have access to professional expertise in damage management but not to professional quality damage management services. Access to aquatic rodent damage management expertise may help to reduce damage. Therefore, this alternative is preferable to Alternative 5, No Management, but less preferable than Alternative 1, IWDM.

Humaneness of methods to be used

This would differ from that discussed under Section 4.2.1, since this alternate would not allow NCWS to directly manage damage using lethal or nonlethal methods. Consequently, this alternative would not consider the needs, desires, and feelings of humans experiencing flooding or other damage due to aquatic rodent activity and would not

allow for the selection of management strategies which would best address humane issues related to both humans and animals. Therefore, under this alternative, NCWS would have no direct effect on humaneness.

Under this alternative, resource owners or managers could continue to use lethal and non-lethal methods to reduce aquatic rodent damage. In addition, some resource/property owners may use illegal methods to control local populations of aquatic rodents out of frustration with continued damage. Some of these illegal actions may cause more pain, suffering, stress, and/or death to both humans and animals than methods used by experienced NCWS personnel.

Stakeholders would have access to professional expertise in aquatic rodent damage management. Access to aquatic rodent damage management expertise may help to limit the use of inappropriate, illegal, or unsafe methods, which may allow for less pain, suffering, stress and death for affected animals. NCWS would recommend nonlethal or lethal methods in a responsible manner and only when applicable and best suited to any particular situation.

4.2.5 Alternative 5. No NCWS Aquatic Rodent Damage Management in North Carolina

As with Alternative 4, the primary difference between this alternative and Alternatives 1-3, is that NCWS would have no direct effect on aquatic rodent populations. NCWS would not even be able to give advice. Resource owners or managers or their agents would have to determine the best approach to damage management without assistance from NCWS.

Effects on aquatic rodent populations

NCWS would have no direct effect on aquatic rodent populations, and aquatic rodent populations would likely continue to increase throughout the state due to inadequate levels of hunting, trapping or damage management. Some local populations of aquatic rodents may remain stable or decline due to local hunting, trapping or damage management. Excessive population densities of aquatic rodents may result in competition and habitat degradation. This, in turn, may result in a decrease in overall population health.

In the absence of the professional services of NCWS available to stakeholders under Alternative 1, some resource owners experiencing damage may trap or shoot aquatic rodents or hire private WDCA's or trappers. Other resource owners experiencing damage may, out of frustration, use poisons or other illegal or unsafe methods to control local populations of aquatic rodents (Walters 1996). The use of illegal or unsafe methods, especially poisons, may have a greater detrimental impact on local aquatic rodent populations than damage management methods available under Alternative 1.

Effects on wetland habitats, plants and other wildlife species, including T&E species

Under this alternative, NCWS would have no direct effect on wetland habitats, plants and other wildlife species. However, due to the severity of aquatic rodent damage in North Carolina, management would likely continue under the direction of other agencies or the private sector. NCWS makes great effort to minimize or eliminate potential harmful effects of aquatic rodent management to natural resources by educating the public regarding the values of wetlands and wildlife, researching and implementing methods to avoid capturing or harming nontarget species, and consulting with USFWS regarding T&E species. Private WDCA's and trappers may not take as thorough of precautions to protect the environment and avoid nontarget species. Some resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping and shooting techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Therefore, in the absence of the professional services of NCWS, negative effects on wetlands, plants and other wildlife may more likely occur than if an IWDM program was available to stakeholders as in Alternative 1.

As aquatic rodent populations continue to increase throughout the state, damage to timber and other agricultural lands or crops, ornamentals plants, native vegetation, wildlife habitat and the species dependent on that habitat, and other natural resources would also continue to increase. Refer to Sections 1.2.2 and 1.2.3 for details regarding beaver damage to wetlands, plants and other wildlife species.

Effects on human and pet health and safety

Under this alternative, NCWS would have no direct effect on human and pet health and safety. In the absence of an organized state-wide aquatic rodent damage management program, unregulated increases in aquatic rodent damage are likely to threaten human and pet health and safety. Refer to sections 1.2.2 for details. Additionally, resource owners may attempt to solve aquatic rodent damage problems using inappropriate trapping, shooting, or explosives techniques (Anonymous 1995) or they may resort to illegal or unsafe methods (Walters 1996). Improper use of management techniques or use of illegal or unsafe techniques may cause increased risks to public and pet safety compared to the professional use of safe and effective management techniques available under Alternative 1.

Impact to stakeholders, including aesthetics

This alternative would not be likely to have any adverse impact on stakeholders interested in direct benefits derived from consumptive or nonconsumptive use of aquatic rodents or those interested in indirect benefits of aquatic rodents, since thriving populations of aquatic rodents already exist throughout extensive portions of North Carolina and under this alternative these thriving populations would continue to exist if no action is taken by non-WS personnel.

Stakeholders experiencing aquatic rodent damage would be negatively impacted by this alternative if no action is taken, since the occurrences and magnitude of damage would increase and many stakeholders would not have personal expertise in damage management or access to professional quality damage management services.

Humaneness of methods to be used

This would differ from that discussed under Section 4.2.1, since this alternate would not allow NCWS to directly manage damage using lethal or nonlethal methods. Consequently, this alternative would not consider the needs, desires, and feelings of humans experiencing flooding or other damage due to aquatic rodent activity and would not allow for the selection of management strategies which would best address humane issues related to both humans and animals. Therefore, under this alternative, NCWS would have no direct effect on humaneness.

Under this alternative, resource owners or managers could continue to use lethal and non-lethal methods to reduce aquatic rodent damage. In addition, some resource/property owners may use illegal methods to control local populations of aquatic rodents out of frustration with continued damage. Some of these illegal actions may cause more pain, suffering, stress, and/or death to both humans and animals than methods used by experienced NCWS personnel.

4.3 SUMMARY OF WS's IMPACTS

Table 4 presents a relative comparison of the anticipated impacts of each of the alternatives as they relate to each of the major issues identified in Chapter 2.

4.3.1 Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the alternatives (Table 4). With regard to Alternative 1, the Proposed Action, and Alternatives 2, Lethal Removal Only, the lethal removal of aquatic rodents

causing damage is not likely to have any adverse affect on aquatic rodent populations in the North Carolina. No risk to public or pet heath and safety is expected from the proposed alternative (Alternative 1). However, for Alternatives 2-5, the lack of integrated management capable of resolving most aquatic rodent damage problems quickly and efficiently may result in unnecessary risks to public or pet health and safety. Although some persons would likely oppose lethal removal of aquatic rodents, the analysis in this EA indicates that such removals would result in no significant cumulative adverse impacts on the quality of the human environment.

Table 4. Summary of Anticipated Cumulative Impacts from the Alternatives Analyzed

	Ajiomative i	Alternative 2;	Alternative 3;	Altémative 4:	Alternative 52		
SSUESHMPACTS	WDM Program Proposed Action)	Lethal Only	Non-lethal Only	Technical Assistance	No Program		
Boaver Populations	Possible reduction in local populations, no statewide effect.	local populations, no statewide effect.	resource owners seek	Damage could increase unless resource owners seek private help.	Damage could increase unless resource owners seek private help.		
Wetland Habitata, plants and other wildlife Species, Including T&E Species	No impact to non-target species populations			No direct impact to non- target species populations	No direct impact to non-target species populations		
	No threat to public and pet safety. Reduction of risks from flooding, burrowing and diseases.	Possible increased threat to safety.	Possible continued risks from flooding, borrowing and diseases.	Continued risk from flooding, burrowing and diseases.	Continued risk from Rooding, burrowing and diseases.		
Humaneness of Method State of	WS uses the most humane methods available.	the most humane methods	WS would not be able to use the most humane methods available in some instances.	Probably considered more humane my some people than lethal measures.	WS would not be able to use the most humane methods available in some instances.		
including Assinetics	Variable. Those receiving damage would probably favor this alternative. Some individuals would oppose this alternative.			Those receiving damage probably oppose this alternative.	Variable. Some people prefer this alternative. Those receiving damage probably oppose this alternative.		

Chapter 5 LIST OF PREPARERS, REVIEWERS, AND CONSULTANTS

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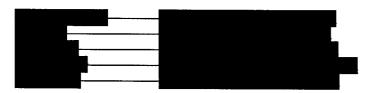
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AUTHORITY AND COMPLIANCE

The USDA is directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Animal Damage Control Act of 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."

Since 1931, with the changes in societal values, WS policies and its programs place greater emphasis on the part of the Act discussing "bringing (damage) under control", rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammals and birds species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

North Carolina Wildlife Resource Commission Legislative Mandate

The NCWRC, under the direction of the Governor-appointed Board of Directors, is specifically charged by the General Assembly with the management of the state's wildlife resources. Although many legal mandates of the Board and the Department are expressed throughout the NC Annotated Code (NCAC), the primary statutory authority is given in Chapter 113, Subchapter IV, Article 22, which states "The...Wildlife Resources of the State belong to the people of the State as a whole. The...Wildlife Resources Commission [is] charged with stewardship of these resources." Elsewhere in this Chapter, the Commission is specifically given powers related to the take, possession, buying and selling of wildlife. Under this authority, the Commission has adopted rules in the NCAC implementing these powers and providing for the stewardship of wildlife resources of the state (C. Betsill, NCWRC, pers. comm.).

NCWRC currently has a MOU with NCWS. This document establishes a cooperative relationship between NCWS and NCWRC for planning, coordinating and implementing wildlife damage management policies in North Carolina.

Compliance with Other Federal and State Statutes

Several federal laws, state laws, and state statutes regulate NCWS wildlife damage management. NCWS complies with these laws and statutes, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act (NEPA)

Environmental documents pursuant to NEPA must be completed before actions consistent with the NEPA decision can be implemented. WS coordinates specific projects and programs with other agencies to conduct any wildlife

damage management that may affect resources managed by these agencies or affect areas of mutual concern.

Endangered Species Act (ESA)

It is federal policy, under the ESA, that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS conducts informal or Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency... is not likely to jeopardize the continued existence of any endangered or threatened species... Each agency shall use the best scientific and commercial data available" (Sec. 7(a)(2)).

Clean Water Act (Section 404)

Section 404 (33 U.S.C. 1344) of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE unless the specific activity is exempted in 33 CFR 323 or covered by a nationwide permit in 33 CFR 330. The removal of most beaver dams is exempt pursuant to 33 CFR 323.4 or authorized by nationwide permit. In addition, a recent court decision, the Tulloch Rule Decision, determined that minimal quantities of material released during excavation activities, such as may occur during beaver dam removal, may be considered "incidental fallback" which would not be governed by Section 404. Activities falling under this category are allowed without a permit (Wayland and Shaeffer 1997).

Food Security Act

The Wetland Conservation provision (Swampbuster) of the 1985 (16 U.S.C. 3801-3862), 1990 (as amended by PL 101-624), and 1996 (as amended by PL 104-127) farm bills require all agricultural producers to protect wetlands on their farms. Wetlands converted to farmland prior to December 23, 1985 are not subject to wetland compliance provisions even if wetland conditions return as a result of lack of maintenance or management. If prior converted cropland is not planted to an agricultural commodity (crops, native and improved pastures, rangeland, tree farms, and livestock production) for more than 5 consecutive years and wetland characteristics return, the cropland is considered abandoned, and it is then considered a wetland and subject to regulations under Swampbuster and Section 404 of the Clean Water Act. The Natural Resource Conservation Service is responsible for certifying wetland determinations according to this Act.

Taking of Beaver

NCGS 113-291.9 allows for the taking of beaver with firearms during any other open season for the taking of wild animals, provided permission has been obtained from the landowner or lessee. It also allows for the use of 330 conibear traps set at least ½ under water and snares for beaver during the beaver trapping season, and for the taking of beaver for damage management on property where damage has occurred using any lawful method without obtaining a depredation permit.

Wildlife Taken For Depredations or Accidentally

NCAC 10B.0106 allows for the taking of wildlife for damage management purposes under Special Depredation Permits and the disposal of said wildlife either on the property or at another location in a safe and sanitary manner. It also allows for the accidental take and disposal of nontarget animals while conducting damage management.

Special Depredation Permit

The NCWRC has issue to NCWS a Special Depredation Permit for the taking of aquatic rodents for damage

management purposes using any necessary means, including, but not limited to, the use of snares and a 72-hour trap check for conibear-type traps set for beaver.

Attendance of Traps

NCAC 10B.0110 requires that every trap must be visited daily and any animal caught therein must be removed.

Nutria Hunting

NCAC 10B.0220 specifies that there is no closed season and no bag limit for hunting nutria.

Trapping

NCAC 10B.0301, 0302, and 0303 set seasons and bag limits for beaver, nutria, muskrat, and other furbearers.

CRITERIA FOR BEAVER DAM BREACHING/REMOVAL

Beaver dams are constructed from natural materials, such as logs, sticks, leaves and mud, that beaver gather from the surrounding area. When beaver dams are removed to reduce flood waters and maintain existing stream channels and drainage patterns, these materials are dislodged and returned to the surrounding area. Beaver dam removal events conducted be WS either manually or using explosives are virtually identical to natural phenomena that commonly occur during heavy rains. During these natural events, large quantities of water flow through beaver impoundments and frequently the dams are washed out and the dam material is returned to the surrounding area.

The impoundments that WS removes are normally from recent beaver activity and have not been in place long enough to take on the qualities of a true wetland (i.e., hydric soils, aquatic vegetation, preexisting function). Beaver dam breaching by hand or with binary explosives does not affect the substrate or the natural course of the stream but merely returns the area to its preexisting condition with similar flows and circulations.

Wetlands are recognized by three characteristics: hydric soils, hydrophytic vegetation, and general hydrology. Hydric soils are either composed of, or have a thick surface layer of, decomposed plant materials (muck); sandy soils have dark stains or streaks from organic material in the upper layer where plant material has attached to soil particles. In addition, hydric soils may be bluish gray or gray below the surface or brownish black to black and have the smell of rotten eggs. Wetlands also have hydrophytic vegetation present such as cattails, bulrushes, willows, sedges, and water plantains. The third indicator is general hydrology which includes standing and flowing water or waterlogged soils during the growing season; high water marks are present on trees and drift lines of small piles of debris are usually present. Beaver dams usually will develop a layer of organic material at the surface because siltation can occur rapidly, but aquatic vegetation is usually not established. However, cattails and willows can show up rapidly if they are in the vicinity, but most hydrophytic vegetation takes time to establish.

The removal of beaver dams involves discharging of dredged or fill materials into waters of the United States, therefore beaver dam breaching is regulated under Section 404 of the Clean Water Act (CWA). In most beaver dam breaching operations, the dredge or fill material that is displaced is exempt from regulation under Section 404 of the CWA (33 CFR Part 323) or covered by a NWP (33 CFR 330). Typically, the landowner is asked the age of the dam or how long he/she has known of its presence to determine whether Swampbuster, Section 404 permit exemptions or NWP's allow breaching of the dam. If it is determined that a dam can not be removed under an exemption or NWP, the landowner is required to obtain a Section 404 permit before the dam can be removed by WS personnel.

The following are specific Section 404 exemptions and NWP's that pertain to the breaching of beaver dams.

33 CFR 323 - Permits For Discharges of Dredged or Fill Material into Waters of the United States. This regulation provides guidance to determine whether certain activities require permits under Section 404.

Part 323.4 Discharges not requiring permits. This section establishes exemptions for discharging certain types of fill into waters of the United States without a permit. Certain minor drainage activities connected with normal farming, ranching, and silviculture activities on established farming, silviculture or ranching operations do not require a permit as long as these drainages do not include the immediate or gradual conversion of a wetland to a non-wetland. Specifically, part (a)(1)(iii)(C)(i) states, "...fill material incidental to connecting upland drainage facilities (e.g., drainage ditches) to waters of the United States, adequate to effect the removal of excess soil moisture from upland croplands...". This indicates that beaver dams that block human constructed ditches, canals, or other structures designed to drain water from upland crop fields can be breached without a permit.

Moreover, (a)(1)(iii)(C)(1)(iv) states the following types of activities do not require a permit "The

discharges of dredged or fill materials incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainageways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainageway as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption."; this allows the breaching of beaver dams in natural streams to restore drainage of agricultural lands within one year of discovery.

Part 323.4 (a)(1)(iii)(E)(2) allows "Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption."; this allows beaver dams to be breached without a permit in situations where dams are located inside serviceable structures (i.e. culverts, bridge abutments) if it is done in a reasonable amount of time.

Part 323.4 (a)(1)(iii)(E)(3) allows "Construction or maintenance of farm or stock ponds or irrigation ditches, or the maintenance of drainage ditches." This indicates that beaver dams that block human constructed ditches, canals, or other structures designed to irrigate or drain water from farms and ranches can be breached without a permit.

33 CFR 330 - Nationwide Permit (NWP) Program. The USACE, Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment. The NWP's are listed in Appendix A of 33 CFR 330 and permittees must satisfy all terms and conditions established to qualify for their use. Individual beaver dam breaching by WS may be covered by a NWP if not already exempted from permit requirements by the regulations discussed above. WS complies with all conditions and restrictions placed on NWP's for any instance of beaver dam breaching done under a specific NWP. Nationwide permits can be used except in any component of the National Wild and Scenic River System such as waterways listed as an "Outstanding Water Resource", or any waterbody which is part of an area designated for "Recreational or Ecological Significance". Two specific NWP's that could be used for breaching beaver dams are:

NWP 3 authorizes the repair, rehabilitation, or replacement of those structures or fills, destroyed by storms, floods, fires, or other discrete events (i.e., beaver dams) provided the repair, rehabilitation, or replacement is commenced, or under commence, within 2 years of the date of their destruction or damage. This NWP allows the discharge of dredge or fill material to remove accumulated sediments and debris in the vicinity of, and within, existing structures (i.e, bridges, road culverts) provided the permittee notifies the District Engineer and removal of sediment is limited to no more than 200 feet from the structure. Furthermore all excavated materials must be deposited and retained in an upland area unless otherwise approved by the District Engineer.

NWP 18 allows minor discharges of dredged and fill material, including the breaching of beaver dams, into all waters of the United States provided that the quantity of discharge and the volume of excavated area does not exceed 25 cubic yards below the plane of the ordinary high water mark and will not cause the loss of more than $^{1}/_{10}$ acre of a special aquatic site including wetlands. For the purposes of this NWP, the loss acreage limitation includes the filled area and excavated area plus special aquatic sites that are adversely affected by flooding and special aquatic sites that are drained so that they would no longer be a water of the United States as a result of the project. Special aquatic sites include wetlands. If the discharge exceeds 10

cubic yards below the plane of the ordinary high water mark or if the discharge is in a special aquatic site, including wetlands, the permittee must notify the District Engineer in accordance with the "Notification" general condition.

A quick response without delays resulting from permitting requirements can be critical to the success of minimizing or preventing damage. Exemptions or NWP's contained in the above regulations provide for the breaching of the majority of beaver dams that NC WS encounters. The flexibility allowed by these exemptions and NWP's is important for the efficient and effective resolution of many beaver damage problems because damage escalates rapidly in many cases the longer an area remains flooded.

METHODS USED BY NORTH CAROLINA WS FOR AQUATIC RODENT DAMAGE MANAGEMENT

A variety of methods and techniques are used to manage aquatic rodent damage. Specific methods are described in USDA (1997, Appendix J: 9 - 12). A formal risk assessment of all mechanical devices used by the WS program in NC can be found in USDA (1997, Appendix P). All lethal and nonlethal methods developed to date have limitations based on costs, logistics, or effectiveness. Below is a discussion of aquatic rodent damage management methods currently available to the NCWS Program. If other methods are proven effective and legal to use in North Carolina, they could be incorporated into the NCWS program in the future.

NON-LETHAL DAMAGE MANAGEMENT METHODS:

Habitat Modification

Habitat Modification for the reduction of aquatic rodent damage refers to manipulation of vegetation or other habitat components to reduce carrying capacity and attractiveness of an area to a particular species.

The best ways to reduce habitat suitability for muskrats and nutria is to eliminate aquatic or other foods eaten by muskrats and nutria and, where possible, to construct pond dams using rip-rap or other methods to prevent muskrats or nutria from burrowing. Habitat alterations to reduce cattail wetlands could reduce the density of muskrats. These types of management practice generally would be conducted by entities other than WS.

Habitat management to reduce or stabilize beaver populations has been used as a component of beaver management. Pond dams can be constructed using rip-rap or other methods to prevent burrowing. Construction of concrete spillways may also reduce or prevent damage to dams from burrowing. Habitat alteration through forest type conversion might be an effective long-term method of reducing beaver density in some areas (Payne 1989). Forest management practices that promote long-lived hardwoods and conifers within 200 - 400 feet of streams may reduce beaver populations on those streams. Payne (1989) suggested that reduced food availability might force beaver colonies to move more often, however, this movement could increase nuisance complaints. These types of management practice generally would be conducted by entities other than WS.

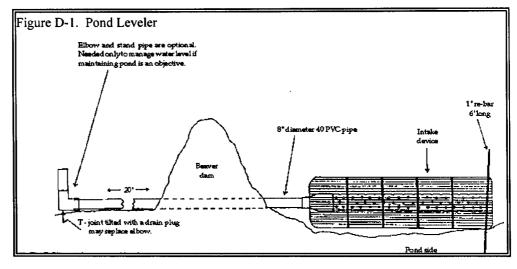
Habitat management may also involve manipulating water levels to reduce damage caused by flooding. Beaver impoundments can be completely drained by removing major dams. Water levels may also be lowered by use of a water-level management device placed in the dam (Laramie and Knowles 1985, Lisle 1996, Miller and Yarrow 1994, Roblee 1983, Roblee 1984, Roblee 1987) (Figure D-1). Water-level management devices that have been used to regulate water levels in beaver ponds include the three-log drain (Roblee 1983), the T-culvert guard (Roblee 1987), wire mesh culvert (Roblee 1983), and the Clemson beaver ponds leveler (Miller and Yarrow 1994). However, application of this strategy has been limited.

Habitat management to reduce beaver populations has the greatest potential for application on federal, state, and county forest lands. At present, there appears to be no large-scale and consistent programs using this beaver damage management strategy.

Continual breaching of dams and removal of dam construction materials on a daily basis sometimes will cause beaver to move to other locations. The Beaver Deceiver is a water control system that attempts to quiet, calm, and deepen the water in front of culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). Constructing culverts that are as wide or wider than stream channels is effective for reducing the likelihood that beaver will plug the culvert (Jensen and Curtis 1999).

Water control devices (pond levelers)

Water control devices (pond levelers) (Figure D-1) have been used for many years in many different states, with varying degrees of success. Various types of beaver pond levelers have been described (Arner 1964, Laramie and Knowles 1985, Lisle 1996, Roblee 1984) and installation of beaver



pond levelers can be effective in reducing flooding in certain situations (Minn. Dept. Nat. Res. 1994, Miller and Yarrow 1994) if properly maintained. Water control devices generally are of two designs. One design is a perforated pipe passing through the beaver dam (Figure D-1) and the second design is a fence erected 15 - 90 feet in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996, E. Butler, USDA/APHIS/WS, pers. comm.). The second design may have a perforated pipe going from the fence to the culvert to allow water to flow since the fence may become clogged with debris. Dams may need multiple devices to accommodate the volume of water in the flowage.

The Beaver Deceiver is a water-level management device that attempts to prevent beaver from damming by eliminating environmental cues that stimulate damming at culverts and by making culverts less favorable as dam sites. This is accomplished by quieting, calming, and deepening the water in front of culverts and constructing an odd shaped fence that both excludes beaver from a large area around the upstream opening of the culvert and confuses them so that they do not construct a dam against the fence. The beaver deceiver has been developing since 1996 and has been effective at controlling beaver flooding in some situations (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

The cost of water control devices is variable, depending on number of devices per dam, type of device, materials used, and labor. Materials and installation of water control devices can be relatively modest for a three-log drain (Arner 1964), \$496 - \$560 for a single modified Clemson leveler (B. Sloan, USDA/APHIS/WS, pers. comm.), \$1050 - \$2,300 for a single beaver stop (DCP Consulting, Calgary, Canada, 1996), or over \$1,000 for a beaver deceiver. A modified beaver deceiver can be constructed for \$250 -\$300, however, annual maintenance costs were estimated at \$350 (E. Butler, USDA/APHIS/WS, pers. comm.).

The use of pond levelers or water control devices may require frequent maintenance, depending on the type device used. Continued maintenance is necessary for the device to remain operational because stream flow, leaf fall, floods, and beaver activity will continuously bring debris to the water control device. Maintenance of water control devices can be expensive. There may also be an annual costs to reduce beaver populations to keep the devices operational (B. Sloan, USDA/APHIS/WS, pers. comm.).

Nolte et al. (2000) found that pond levelers placed in sites with high beaver activity without implementing local population control measures frequently failed. Ninety-five percent of the successful levelers in this study were at sites that had received some local population control measure either before, after, or before and after the leveler was installed (Nolte et al. 2000). Wood et al. (1994) also acknowledged that pond levelers do not negate the need for reduction of

local beaver populations. Beaver may block the device or may build additional dams upstream or downstream, inhibiting the success or function of the device.

Water control devices are most effective in specific types of terrains and sites (NYDEC 1997, Wood et al. 1994). Water control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, pers. comm.) and may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). They may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device to handle and debris is continuously carried to the site. Also, water control devices may not be effective during periods of unusually high rainfall or increased water flow because the device cannot handle the increased volume of water (Anonymous 1999; Wood et al. 1994).

One benefit of water control devices is that the beaver pond or wetland area can be maintained or improved, along with the ecological and recreational benefits derived from these areas (see Chapter 1, pages 3&4, of the EA), while the damage from beaver flooding is alleviated or at least reduced. However, water control devices are not applicable or efficient in all damage situations. Landowners consider many factors in determining the course of action to resolve beaver damage problems. For example, landowners must consider the cost of control, the probability that the method will resolve the problem, the amount of maintenance required, and whether the method is consistent with objectives for the property (Nolte et al. 2000).

If a water control device (fence or pipe system) is consistent with the landowners objectives, will alleviate the damage, and if funding is available for installation, then WS would use or recommend their use. WS would also provide technical assistance to landowners who want to install these devices on their own.

Exclusion

Exclusion involves using fencing or other barriers to prevent aquatic rodents from gaining access to protected resources. Fencing of small critical areas such as around culverts and drain pipes can sometimes prevent beaver from plugging them. Fencing can also be used to protect trees or shrubs from girdling or gnawing. In these situations hardware cloth, flashing, or chain links are installed around the plants to be protected. Recent preliminary tests by WS's NWRC suggest that sand mixed in paint may be an effective barrier against beaver gnawing and cutting of trees or other objects (D. Nolte, NWRC, unpubl. data). Exclusion has also been used to prevent beaver from plugging road culverts when a metal screen, grate, or fencing is secured in front of the opening. A variety of road culvert screens or fences have been used by county and local highway departments. In most cases the screens do not solve a damage problem, as workforce is still required to remove beaver dam materials from the screen or fence itself. The main benefit of this technique is to prevent beaver dam materials from being deposited inside the culvert.

Electrical barriers have proven effective in limited situations for mammals and birds; an electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at keeping mammals and birds out. The effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted because beaver will avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997).

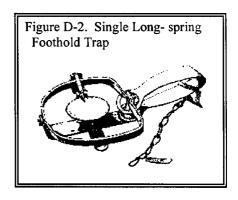
Protecting ornamental or landscape trees from aquatic rodent damage by using hardware cloth or other types of screening or grit paint is frequently recommended by WS. This method is used most frequently by home owners. It is rarely, if ever, used to prevent large-scale timber or forest damage due to the high material cost and labor required to wrap hundreds or thousands of trees in a managed forest.

Beaver Dam Removal

Beaver dam removal is generally conducted to maintain existing stream channels and drainage patterns, and to reduce flood waters that have affected established silviculture, agriculture, and other activities or drainage structures. Unwanted beaver dams can be removed by hand or with explosives.

Explosives

Explosives are generally used to remove beaver dams after beaver have been removed from a damage situation. WS uses only binary explosives. Binary explosives are not explosive until they are mixed. Therefore, these chemicals are subject to fewer regulations and controls. However, once mixed, binary explosives are considered high explosives and subject to all applicable federal requirements. Detonating cord and blasting caps are considered explosives



and WS must adhere to all applicable State and Federal regulations for storage and handling. All WS explosive specialists are required to attend 30 hours of intensive explosive safety training and spend time with a certified explosive specialist in the field prior to obtaining certification. All blasting activities are conducted by well trained, certified blasters and closely supervised by professional wildlife biologists. Explosive handling and use procedures follow the rules and guidelines set forth by the Institute of Makers of Explosives, the safety arm of the commercial explosive industry in the United States and Canada. WS also adheres to transportation and storage regulations from State and Federal agencies such as Occupational Safety and Health Association, Alcohol-Tobacco-Firearms, and the Departments of Transportation.

LETHAL DAMAGE MANAGEMENT METHODS

These methods involve reducing population densities to a level that stabilizes, reduces, or eliminates damage. The level of removal necessary to achieve a reduction of damage varies according to the resource protected, habitat, population, the effectiveness of other damage management strategies, and other ecological factors.

Specific methods of lethal population reduction involve removing aquatic rodents with conibear-type and foothold traps, snares, and shooting. Aquatic rodents can also be live-captured with foothold traps, cage-type traps and snares. However, the NCWRC does not allow relocation of beaver. These techniques are usually implemented by WS personnel because of the technical training required to use such devices. Despite the numerous damage management methods developed, trapping remains the most effective method of removing beaver (Hill 1976, Hill et al 1977, Wigley 1981, Weaver et al 1985), muskrats and nutria and of managing damage in specific damage areas. Intensive trapping can eliminate or greatly reduce aquatic rodent populations in limited areas (Hill 1976, Forbus and Allen 1981).

Foothold traps

Foothold traps (Figure D-2) are designed to capture and hold animals, without harm, by the foot and can be effectively used to capture a variety of mammals. Foothold traps are either placed beside, or in some situations, in travel ways being actively used by the target species. Placement of traps is contingent upon the habits of the respective target species, habitat conditions, and presence of non-target animals. Effective trap placement and adjustment and the use and placement of appropriate baits and lures by trained WS personnel also contributes to the foothold trap's selectivity. An additional advantage is that foothold traps can allow for the on-site release of non-target animals. The use of foothold traps requires more skill than some methods, but they are indispensable in resolving many damage problems. Aquatic rodents live-captured in foothold traps would be killed.

Conibear-type traps

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Conibear-type traps are designed to capture animals by the neck or body and cause quick death. The size 330 Conibear-type trap is generally used for beaver exclusively in the water, with placement depths varying from half-out to several feet below the water surface (Figure D-3). Smaller Conibear traps used for muskrats can be set either in or out of the water. Placement is often in travel ways or at lodge or burrow entrances created or used by the target species with the animal captured as it travels through the trap and activates the triggering mechanism.

Since 1993 NCWS has had a special permit from the NCWRC allowing a 72-hour trap-check period for conibear-type traps. No problems have occurred with the 72-hour trap check, and the WRC is considering bringing forward such a proposed regulation change for trappers statewide.

Snares

Snares are capture devices comprised of a cable formed in a loop with a locking device and placed in travel ways. Most snares are also equipped with a swivel to minimize cable twisting and breakage. Snares are easier than foothold traps to keep operational during periods of inclement weather. Snares generally are set to live-catch an animal around the body or leg. Aquatic rodents captured in snares would be killed.

Hancock Traps

Hancock traps (suitcase/basket type cage traps) are designed to live-capture beaver. The trap is constructed of a metal frame that is hinged with springs attached and covered with chain-link fence. The trap's appearance is similar to a large clam when closed. When set, the trap is opened to allow an animal to enter, when tripped the trap closes around the animal. One advantage of using the Hancock trap is that beaver or non-target animals can be released. Beaver caught in Hancock traps could also be killed. Disadvantages are that these traps are very expensive (approximately \$275 per trap), cumbersome, and difficult to set (Miller and Yarrow 1994). The trap weighs about 25 pounds and is relatively bulky to carry and maneuver. Hancock traps can also be dangerous to set (i.e., hardhats are recommended when setting suitcase traps), are less cost and time-efficient than snares, leg-holds, or body-grip traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999).

Colony Traps

Colony traps are multi-catch traps used to either live-capture or capture and quickly drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1987b). The traps are set at the entrance to muskrat burrows or placed in muskrat travel lanes. Colony traps are effective and relatively inexpensive and easy to construct (Miller 1994). The stovepipe trap, a common type of colony trap, is usually made with sheet metal and may capture two to four muskrats per night (Miller 1994).

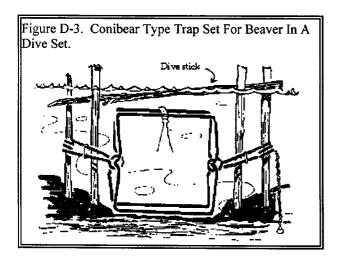
Shooting

Shooting is selective for target species and may involve the use of spotlights and a shotgun or rifle. Shooting is an effective method to remove small numbers of aquatic rodents in damage situations, especially where trapping is not feasible. Removal of specific animals in the problem area can sometimes provide immediate relief from a problem. Shooting is sometimes utilized as one of the first lethal damage management options because it offers the potential of resolving a problem more quickly and selectively than some other methods, but it does not always work.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to

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certify that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.



ATTACHMENTS

Biological Assessments and Letters of Concurrence

Contents

NCWS. 1996. Biological assessment for managing beaver damage in the Piedmont, Sandhills, and Coastal Regions of North Carolina. 9pp.

Letter from USFWS to NCWS dated October 23, 1996. 1p.

NCWS. 1999. Biological assessment for managing beaver damage in western North Carolina. 6pp + appendix.

Letter from USFWS to NCWS dated September 2, 1999. 1p.

E-mail correspondence between USFWS and NCWS dated July 12 & 13, 2001. 2pp

BIOLOGICAL ASSESSMENT FOR

MANAGING BEAVER DAMAGE IN THE PIEDMONT, SANDHILLS, AND COASTAL REGIONS OF NORTH CAROLINA

October 8,1996

Introduction

This analysis, a requirement of section 7(c) of the Endangered Species Act (ESA), is meant to assist the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control (ADC) in facilitating compliance with section 7 (a)(2) of the ESA, which requires that each Federal agency insure, in consultation with the Fish and Wildlife Service (FWS), that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any listed species or result in the adverse modification of designated "critical" habitat (Animal and Plant Health Inspection Service 1995).

Following is a description of an action for managing beaver caused damage in the piedmont, sandhills, and coastal plain of North Carolina. The action is part of an on-going program, some of which was covered under the formal section 7 consultation between ADC and FWS completed in 1992 (U. S. Dept. of Agric. 1994, Vol. 2, Appendix F). The analysis presented in Appendix F of the ADC Final Environmental Impact Statement (FEIS) did not evaluate the "may affect" determination on habitat manipulation methods, therefore this document addresses one habitat manipulation method (removal of beaver dams) which is commonly used by ADC.

Description of Action

The action is an on-going program to conduct beaver damage management activities for the protection of state highway and road infrastructure, agricultural and timber resources, personal property, human health and safety, and natural resources.

ADC presently administers a Beaver Management Assistance Program (BMAP) through a cooperative service agreement with the cooperative service agreement, ADC administers the BMAP under the guidance of an advisory board chaired by the WRC and comprised of representatives from the North Carolina Department of Agriculture, North Carolina Division of Forest Resources, North Carolina Soil and Water Conservation Division, North Carolina Cooperative Extension Service, North Carolina Department of Transportation (NCDOT), North Carolina Farm Bureau Federation, North Carolina Forestry Association, and ADC. The BMAP is funded by the participating counties and landowners, and the U.S. Department of Agriculture.

ADC currently uses an Integrated Wildlife Damage Management (IWDM) approach utilizing a variety of methods for managing beaver damage which allows greater flexibility and more opportunity to formulate

an effective strategy for each specific request for assistance. In selecting control techniques, consideration is given to the type and magnitude of damage, duration and frequency, and location of damage. Consideration is also given to the status of potential nontarget species. These factors are evaluated in formulating control strategies that incorporate the application of one or more techniques. The decision-making steps ADC personnel take when addressing beaver damage are represented by the ADC Decision Model in the ADC Final Environmental Impact Statement (FEIS) (U.S. Dept. of Agric. 1994, Vol.2, Figure 2-4).

Requests for assistance may be handled through direct control or technical assistance. Most ADC direct control efforts involve lethal control aimed at specific offending animals which is conducted in response to specific incidents of damage. Lethal control is achieved through the use of leghold traps, Conibear traps, snares, and shooting. A risk assessment conducted by ADC addresses the use of these control methods as well as risks associated with them (U.S. Department of Agriculture, 1994, Vol. 2, Appendix P).

Technical assistance may include providing advice, information, recommendations, and materials to others for use in resolving beaver damage. In situations where nonlethal control is effective, ADC utilizes methods which might include wire guards on trees, barriers on culverts, or water levelers for managing beaver ponds. However, the use of these methods has limited applicability. Live relocation would be biologically unsound due to the high density of beaver throughout the state and would not reduce the amount of beaver damage.

Habitat management is achieved through the removal of beaver dams where flooding prevents regular land use practices such as agriculture production and timber harvest; or where the integrity of highways, railways, or bridges are threatened.

Beaver dams are be removed manually by hand-raking or through the use of binary explosives manufactured by Kinepak, Inc. The two-component explosive consists of Ammonium Nitrate (also used as fertilizer) contained in 1 lb. plastic containers in powder form, and Nitromethane, a combustible liquid contained in plastic pouches (4 oz./pouch). The components are not considered explosive until mixed at the site where used. Mixing is achieved by unscrewing the cap of the solid component and inserting the open end of the pouch containing the liquid after cutting off the end of the pouch. After all of the liquid has been absorbed by the solid component, the empty plastic tube is removed and the cap is replaced on the plastic container which is now an armed explosive.

After the explosives are armed the 1 lb. charges are placed within the dam via holes punched through the top of the dam. The charges are tied together with detonating cord and a detonator is attached. The explosive specialist then detonates the explosive charges.

An average of three to four 1 lb. charges are used for each beaver dam removed. Upon detonation explosive components reach 2000 degrees fahrenheit. All explosive components are consumed by the heat, including the plastic container and no residue is introduced into the environment (Bob Leblanc, Kinepak, Inc. pers. comm.). Empirical information indicates that aquatic or semi-aquatic wildlife species in the immediate vicinity of the explosion may be injured or killed, however, no information related to impacts resulting from the force of an explosion is available.

Dam removal projects using explosives are normally one-time, short term events conducted to restore water flows in small previously existing drainages which normally include small watershed streams, tributary drainages, or ditches. The amount of material removed is usually less than five cubic yards per site. ADC explosive specialists use the least amount of explosives to loosen or remove the dam, utilizing the pressure from water impounded behind the dam to help wash it out. Only that portion of the dam blocking the actual stream or drainage is altered or removed, with care taken to avoid alteration of the pre-existing channel or damage to stream banks.

Potential Impacts on Threatened and Endangered Species

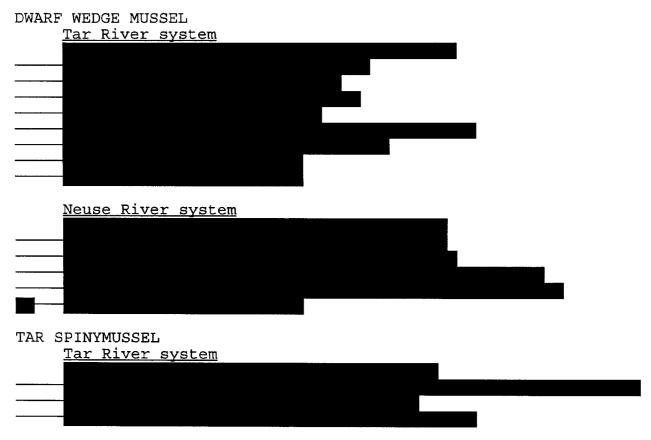
We have evaluated potential impacts of the action on federally listed (T&E) species. Unless otherwise noted, the technical information presented in this section was gathered from information contained in the *Red Book* (U.S. Fish and Wildlife Service, 1991,1992,1993,1994,1995). Additional information on listed mussels and fishes was obtained from an updated list of areas of concern for federally listed aquatic animals in North Carolina (USFWS, Ecological Services Field Office, Asheville, NC).

Following is a brief description of the biology and status of listed species as well as an analysis of "effects of the action" on the listed species and associated habitat.

Mussels

The Tar spinymussel (*Elliptio steinstansana*) inhabits relatively silt-free, uncompacted gravel and/or coarse sand in fast-flowing, well oxygenated stream reaches. The dwarf wedge mussel (*Alasmidonta heterodon*) lives in sand, muddy sand, and gravel substrate in large rivers and small creeks where the current is slow to moderate and where there is little silt.

It has been determined that populations of these two endangered mussels exist in areas where ADC conducts some beaver management activities. A list of where each species is currently known to occur follows.



The removal of beaver dams with explosives may have a positive or negative impact on either species of mussel. Siltation resulting from the sudden release of sediment from the dam is the most obvious manner in which an impact might occur. ADC will consult with FWS, Raleigh Field Office, before removing beaver dams with explosives in any of the waters listed above so that FWS can evaluate potential impacts. Explosives will be used to remove beaver dams in these waters only after approval by FWS.

The Carolina heelsplitter (Lasmigona decorata) inhabits cool, slow-moving, small to medium-sized streams and rivers. It is found in three creeks in Union County, NC. The Appalachian elktoe (Alasmidonta raveneliana) inhabits the Nolichucky River system in Swain, Macon, Yancey, and Mitchell Counties. The Little-wing pearlymussel (Pegias fabula) inhabits the Little Tennessee River in Swain and Macon Counties. ADC activities are not conducted in these counties.

Insects

The American Burying Beetle (*Nicrophorus americanus*) is believed to be extirpated in North Carolina.

The Saint Francis' satyr butterfly (Neonympha mitchellii francisci) is extremely rare and is known to exist as only a single population

in North Carolina on lands managed by the Department of Defense.

ADC beaver management activities are not likely to affect either of these two species.

Fish

Four federally listed species of fish occur in North Carolina.

The Spotfin chub (Cyprinella monacha) inhabits moderate to large streams with a good current and clear water. In North Carolina, it is present only in the Little Tennessee River in Swain and Macon Counties. No beaver management activity is conducted by ADC in these counties.

The Shortnose sturgeon (Acipenser brevirostrum) is found in coastal rivers.

The Waccamaw silverside (Menidia extensa) resides in Lake Waccamaw, Columbus County. To date, ADC has not conducted beaver activities in the immediate vicinity of the lake. If beaver dams were removed in any of the lake's tributaries the discharge would be minimal and have little affect on Lake Waccamaw.

The Cape Fear shiner (Notropis mekistocholas) is known from four small populations in the Cape Fear drainage in Randolph, Moore, Lee, Harnett, and Chatham Counties. Critical habitat occurs in four of the above counties. It requires clean streams in a rocky, riverine habitat. Beaver impounded water may likely pose a threat to the species due to siltation and alteration of stream flows, however, impacts associated with removal of beaver dams are uncertain.

In order to avoid any adverse affects to the Cape Fear shiner, ADC will consult with FWS before removal of any beaver dams in Bear Creek, above the confluence with the Rocky River in Chatham County.

In consideration of the above mentioned consultation, ADC beaver management activities are not likely to adversely affect any of these species.

Reptiles

Six federally listed species of reptiles occur in North Carolina.

Five species of marine turtles listed as endangered include the Leatherback (Dermochelys coriacea), Loggerhead (Caretta caretta), Green Turtle(Chelonia mydas), Hawksbill (Eretmochelys imbricata), and Kemp's ridley sea turtle (Lepidochelys kempi). All five species spend most of their life cycle in marine environments, coming ashore only to lay their eggs.

Due to the habitat requirements of the above listed reptiles, these species would not likely be affected by ADC beaver management activities.

The American alligator (Alligator mississippiensis) is listed as threatened due to similarity of appearance to allow safeguards against exploitation. The species would not be adversely affected by ADC beaver management activities.

Birds

Ten federally listed species of birds occur in North Carolina.

The Bald eagle (Haliaeetus leucocephalus) is known to nest over a large portion of the state. ADC has consulted with the U.S. Fish and Wildlife Service (USFWS) regarding potential impacts for this species and abides by reasonable and prudent measures established as a result of that consultation (U.S.Dept.Agri.1994).

Bachman's warbler (*Vermivora bachmanii*) and the Ivory-billed woodpecker (*Campephilus principalis*) are believed to be extirpated from North Carolina.

The Piping plover (Charadrias melodus), Roseate tern (Sterna dougallii dougallii), and American peregrine falcon (Falco peregrinus anatum) range and habitat requirements would preclude any impacts from ADC beaver management activity.

The Kirtland's warbler (*Dedroica kirtlandi*) has been observed in North Carolina during spring and fall migration.

The Red-cockaded woodpecker (*Picoides borealis*) nests in open stands of pine with a minimum age of 80 to 120 years. Foraging habitat is provided in pine and pine hardwood stands thirty years old or older.

The Peregrine falcon (Falco peregrinus) is endangered due to similarity of appearance.

The Wood stork (*Mycteria americana*) is not known to nest in North Carolina. They are occasionally observed in freshwater and brackish wetlands.

It is unlikely that ADC beaver management activities would adversely affect any of the ten federally listed species of birds in North Carolina. Beaver management, including dam removal, could benefit Red-cockaded Woodpecker's through reclamation of pine timber stands that have been recently inundated by beaver impounded water.

The USFWS Biological Opinion (U.S. Dept.Agri.1994) determined that

the Piping plover, Roseate tern, and Wood stork would not be adversely affected by any aspect of the ADC program. Possible effects related to beaver management can be found in the Biological Opinion for the Bald Eagle, Red Cockaded Woodpecker, and American Alligator. For the full context of the Biological Opinion see the ADC FEIS, Appendix F (USDA 1994).

Mammals

Fourteen species of mammals are federally listed in North Carolina.

The Dismal Swamp southeastern shrew (Sorex longirostis fisheri), Finback whale (Balaenoptera physalus), Gray bat (Myotis grisescens), Humpback whale (Megaptera novaeangliae), Indiana bat (Myotis sodalis), Right whale (Balaena glacialis), Sperm whale (Physeter catodon), Sei whale (Balaenoptera borealis), Virginia Big-eared bat (Plecotus townsendii virginianus) and West Indian Manatee (Trichechus manatus) would not likely be affected by ADC beaver management activities due to their range and/or habitat requirements.

The Eastern cougar (Felis concolor couguar) and the Grey wolf (Canus lupus) are believed to be extirpated from North Carolina.

The USFWS Biological Opinion (U.S.Dept.Agri.1994) lists species which the USFWS believes will not be adversely affected by any aspect of the ADC program. Species on the list which occur in North Carolina include Northern flying squirrel (Glaucomys sabrinus coloratus) and Red wolf (Canus Rufus).

Plants

Twenty six species of plants are federally listed in North Carolina. Thirteen of these species occur in the Mountain region of the state. ADC beaver management work is conducted only in the eastern piedmont, sandhills, and coastal portions of the state and therefore would not adversely affect any of these species which include: Blue Ridge goldenrod (Solidago spithamaea), Bunched (Sagittaria arrowhead fasciculata), Dwarf-flowered heartleaf (Hexastylis naniflora), Green pitcher plant (Sarracenia oreophilia), Heller's blazing star (Liatris helleri), Mountain golden heather (Hudsonia montana), Mountain sweet pitcher plant (Sarracenia rubra spp. jonesii), Roan mountain bluet (Hedyotis montana), Small whirled poqonia medeoloides), Spreading avens (Geum radiatum), Swamp pink (Helonias bullata), Virginia spirea (Spirea virginiana), and White irisette (Sisyrinchium dichotomum).

American chaffseed (Schwalbea americana) exists in a single

population at Fort Bragg on sandy, acidic, seasonally moist to dry soil.

Canby's dropwort (Oxypolis canbyi) occurs in coastal plain wetlands. One population exists in Scotland County on Nature Conservancy land.

Cooley's meadowrue (*Thalictrum cooleyi*) occupies eleven sites in Pender, Onslow, Brunswick, and Columbus Counties on privately owned land. It inhabits moist to wet bogs and savannahs.

Harperella (Ptilimnium nodosum) inhabits shoals or margins of swift flowing streams in Granville and Chatham counties. Populations can be negatively affected by alteration of water regimes such as the impoundment or drainage of water. If alteration of the water regime was caused by the impoundment of water by beaver, then beaver management would have a positive effect.

Michaux's sumac (Rhus michauxii) grows on dry sites in sandy or rocky open woods in association with basic soils.

Pondberry (Lindera melissifolia) is associated with wetland habitats in shaded areas. One population exists in Bladen County. ADC will consult with USFWS if beaver management work is requested in proximity to the site.

Rock gnome lichen (Gymnoderma lineare) would not be affected.

Rough-leaved loosestrife (Lysimachia asperulaefolia) is endemic to the North Carolina coastal plain, existing in nine counties. Most of the remaining populations are managed on public lands administered by the Department of Defense, WRC, U.S. Forest Service, and the North Carolina Department of Environment, Health, and Natural Resources. To date, no ADC beaver work has been conducted on these lands. Any work conducted on these lands would be done so in consultation with those managing agencies and FWS.

Schweinitz's sunflower (Helianthus schweinitzii) is found in clearings and upland woods in open habitats. It is located in five central and western piedmont counties. No ADC beaver management activities are conducted in these counties.

Seabeach amaranth (Amaranthus pumilus) is found on Atlantic ocean beaches, mostly on barrier islands.

Sensitive jointvetch (Aeschynomene virginica) at two sites in North Carolina in the intertidal zone.

Small-anthered bittercress (*Cardamine micranthera*) is found in the Dan River drainage of the western piedmont portion of the state where no ADC beaver management activities take place.

Smooth coneflower (*Echinacea laevigata*) is not found in association with moist sites. Populations exist in Durham and Granville counties.

Arachnid and Snail

The Spruce-fir moss spider (Microhexura montivaga) and the Noonday globe (Petera (Mesodon) clarki nantahala) would not be adversely affected by ADC beaver management activity due to their range and habitat requirements.

Conclusion

It is believed that beaver management activities conducted by ADC are not likely to adversely impact any threatened or endangered species in North Carolina.

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Consultations

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BIOLOGICAL ASSESSMENT FOR MANAGING BEAVER DAMAGE IN WESTERN NORTH CAROLINA

August 4, 1999

INTRODUCTION

This document, a requirement of section 7(c) of the Endangered Species Act (ESA), is meant to assist the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) in complying with section 7 (a)(2) of the ESA, which requires that each Federal agency, in consultation with the U.S. Fish and Wildlife Service (USFWS), insure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any listed species or result in the adverse modification of designated "critical" habitat (Animal and Plant Health Inspection Service 1995).

A previous document (U.S. Dept. of Agric., Wildlife Services. 1996) addressed the potential effects of beaver damage management activities conducted by WS on federally listed species in the Piedmont, Sandhill, and Coastal Plain Regions of North Carolina. This document addresses the potential effects of beaver damage management activities on listed species in western North Carolina, including primarily the Mountain Region but also some counties and species not addressed in the previous document.

WS uses an Integrated Wildlife Damage Management (IWDM) approach, incorporating a variety of methods for managing beaver damage. IWDM allows flexibility and opportunity to formulate effective strategies for specific damage situations. In formulating damage control strategies that incorporate the application of one or more techniques, consideration is given to a variety of factors including the type, magnitude, duration, frequency, and location of damage, and the status of potential nontarget species. The decision-making steps WS personnel take when addressing beaver damage are discussed in the Animal Damage Control (ADC) Final Environmental Impact Statement (FEIS) (U.S. Dept. of Agric. 1994, Vol.2, pp. 23-34).

Requests for assistance may be handled through technical or direct assistance. Technical assistance includes providing advice, information, recommendations, and materials to others for resolving beaver damage through the use of a variety of nonlethal or lethal techniques.

Direct assistance involves the resolution of beaver damage situations by WS personnel. Direct assistance activities may include the use of nonlethal methods, such as water control structures. However, the use of these methods has limited applicability. In

situations where nonlethal methods are ineffective, lethal methods aimed at specific offending animals may be conducted in response to specific damage incidents. Lethal damage control is achieved through the use of traps, snares, and shooting. In conjunction with lethal methods, habitat manipulation is achieved by removing beaver dams.

An analysis conducted by WS addressed the risks associated with the use of traps, snares, and shooting to resolve beaver damage problems (U.S. Department of Agriculture, 1994, Vol. 3, Appendix P). These methods are not likely to adversely effect any listed species in North Carolina (U. S. Dept. of Agric. 1994, Vol. 2, Appendix F).

The analysis presented in Appendix F of the FEIS did not evaluate the "may affect" determination on habitat manipulation methods. This document addresses two habitat manipulation methods (i.e., removal of beaver dams and installation of beaver pond levelers) which are used by WS.

DESCRIPTION OF ACTION

Habitat manipulation, part of an ongoing program to conduct beaver damage management activities in western North Carolina, is achieved through the removal of beaver dams or the use of beaver pond levelers where flooding threatens state highway and road infrastructures, agricultural and timber resources, personal property, human health and safety, and natural resources.

Dam Removal

Beaver dams are removed manually by hand-raking or through the use of binary explosives. The two-component explosive consists of ammonium nitrate contained in plastic containers, and nitromethane contained in plastic pouches. The components are not considered explosive until mixed at the site where used. Mixing is achieved by pouring the nitromethane into the ammonium nitrate.

After the explosives are armed, the charges are tied together with detonating cord and placed into holes made through the top of the dam. A detonator is then attached and the explosive charges are detonated by an Explosives Specialist. Upon detonation explosive components reach 2000 degrees fahrenheit. All explosive components are consumed by the heat, including the plastic container and no residue is introduced into the environment (U.S. Dept. of Agric., Wildlife Services. 1996).

Field observations indicates that aquatic or semi-aquatic wildlife species in the immediate vicinity of the explosion may be injured or killed. However, no information related to impacts resulting from the force of an explosion is available.

Dam removal projects using explosives are normally one-time, short-term events conducted to restore water flows in small previously existing drainages (eg. small watershed streams, tributaries, or ditches). WS explosive specialists use the least amount of explosives necessary to remove a dam. Only that portion of the dam blocking the main channel is removed. Specialists are careful to avoid alteration of the pre-existing channel or damage to stream banks.

Beaver Pond Levelers

A beaver pond leveler is a specialized pipe which allows continuous water flow through a beaver dam. Levelers are installed by removing a section of beaver dam. The initial

and long term effect on habitat is similar to that resulting from dam removal.

POTENTIAL IMPACTS ON LISTED SPECIES

Technical information regarding listed species presented in this section was gathered from the USFWS web sites located at web.ral.r4.fws.gov and www.fws.gov. Additional information was obtained from updated lists provided by USFWS, Ecological Services Field Office, Asheville, North Carolina.

The removal of beaver dams may have a positive or negative effect on aquatic or water- dependent listed species. Positive effects could occur via the restoration of habitat valuable to listed species. For example, opening a section of stream channel allowing natural water flow and silt removal could restore habitat valuable to listed mussels (cf. U.S. Dept. of Agric., Animal Damage Control. 1995, 1996). Negative effects could occur via the loss of wetland habitat valuable to listed species or the sudden release of silt into downstream areas and the loss of the filtering effect of beaver dams.

Informal consultations with USFWS indicated concern with aquatic and water-dependent species likely to occur within the area of potential beaver damage management activities. Consequently, we excluded from further analysis all federally listed threatened or endangered species occurring in the State of North Carolina except for those specifically discussed below. A complete list of federally listed threatened and endangered species occurring in North Carolina which were considered in developing this document is provided in Appendix A.

The following is a brief description of the habitat requirements and distribution of federally listed aquatic and water dependent species occurring in western North Carolina. To date, WS has not conducted any beaver management activities in any of the counties listed below except and and Counties. In these counties, no work has been done in areas where listed species are a concern.

Mussels

Three federally listed species of mussels occur in western North Carolina.

The Carolina heelsplitter (*Lasmigona decorata*) inhabits muddy substrates along shaded stream banks in streams and rivers. It occurs in Waxhaw Creek and a short section of Goose Creek in Union County, North Carolina.

The Appalachian elktoe (*Alasmidonta raveneliana*) inhabits clean gravel substrates, cracks in bedrock, or relatively silt-free coarse sandy substrates in shallow, medium-sized streams with cool well-oxygenated, moderate- to fast-flowing water. It occurs in North Carolina in a short section of the Little Tennessee River in Swain and Macon Counties and short sections of the Tuckaseegee River in Jackson and Swain Counties. It also occurs in sections of South Toe River in Yancy County, the Toe River in Yancy and Mitchell Counties, the Cane River in Yancy County, the main stem of the Nolichucky River in Yancy and Mitchell Counties, and Pigeon River in Haywood County.

The Little-wing pearlymussel (*Pegias fabula*) occurred historically in Valley and Hiwassee Creeks in Cherokee County, North Carolina. However, it may be extirpated from these localities. It is known to occur in the Tennessee River in Swain County.

The above listed mussels generally inhabit larger streams and rivers, while beaver generally build dams on smaller tributary streams. Beaver management activities conducted by WS on tributaries flowing into the above listed waterways would result in the release of only a relatively small amount of silt which would then flow downstream toward the larger streams potentially inhabited by mussels. Therefore, beaver damage management activities conducted by WS on these tributaries are not likely to adversely affect any listed species. WS will, however, consult with USFWS before removing beaver dams in any of the waterways listed above.

Fish

One federally listed species of fish occurs in western North Carolina.

The spotfin chub (*Cyprinella monacha*) inhabits clear water with moderate current over gravel, boulder or bedrock substrates in moderate to large streams. In North Carolina, it occurs only in the Little Tennessee River in Swain and Macon Counties. A recent study indicates that suspended sediment may adversely affect reproductive success in some fish species. However, the affects of dam removal on suspended sediment would be minor and short term and are therefor not likely to adversely affect Spotfin chub.

Beaver damage management activities conducted by WS are not likely to adversely affect this species.

Plants

Dwarf-flowered heartleaf (*Hexastylis naniflora*) inhabits acidic sandy-loam soils on bluffs, slopes, hillsides, and ravines, as well as boggy areas adjacent to streams. It occurs in Cleveland, Rutherford, Polk, Lincoln, Catawba, Burke, and Caldwell Counties.

Small-anthered bittercress (*Cardamine micranthera*) inhabits seepages, wet rock crevices, stream banks, sandbars, and wet woods along small streams in the Dan River drainage in Stokes and Forsyth Counties.

Beaver damage management activities conducted by WS are not likely to adversely affect either of these species.

CONCLUSION

Beaver damage management activities conducted by WS are not likely to adversely affect any threatened or endangered species in western North Carolina.

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